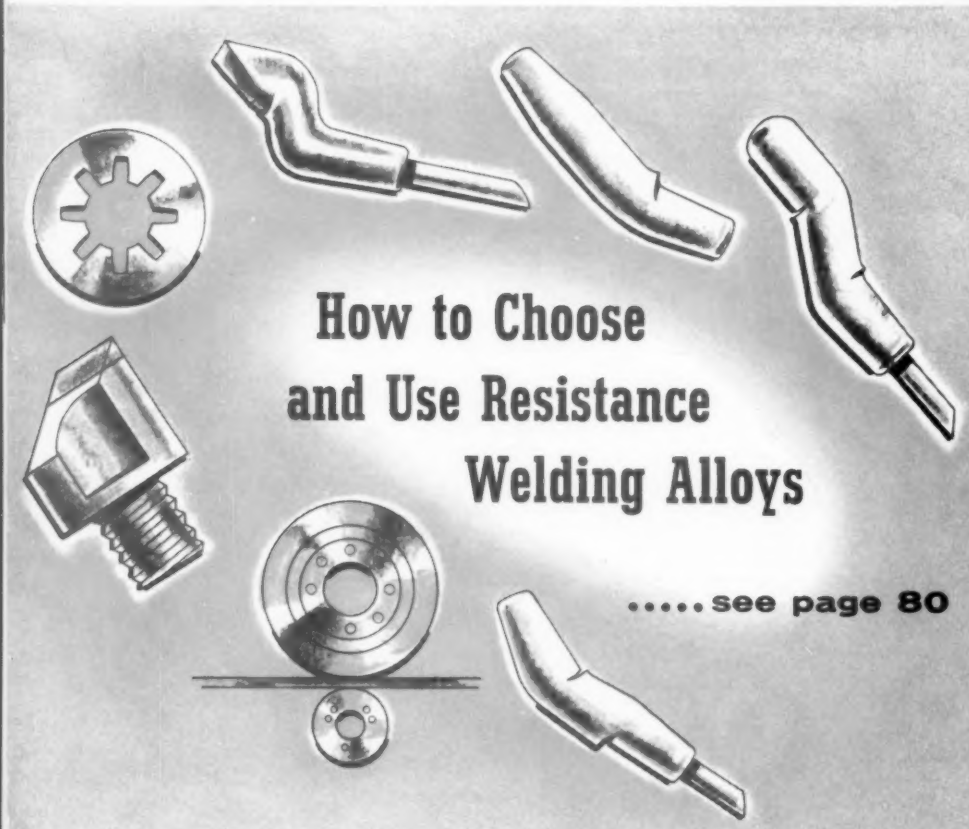
INDUSTRY & WELDING

SEPTEMBER 1956



How to Choose and Use Resistance Welding Alloys

.....see page 80

FRANCHISE CIRCULATION

ALSO IN THIS ISSUE

Submerged Arc Eliminates Stop and Go Welding.....50
How to Use Silver Brazing Preforms.....74
Techniques for Joining Dissimilar Steel Piping.....86

Medium-class holder, model A-W, 14 ounces. Lightest holder made to take 1/4" rods, rated 300 amps, with its long lever, and fitting the hand like a glove, is the most popular in the Jackson line.

Large-class model A-5S, 21 ounces, takes 5/16" rods at 400 amps, has wider lower tong for firm grip, larger diameter handle.

Aluminum alloy tongs for lightness, and high-copper alloy jaws for durability, account for the year-after-year popularity of Jackson Featherlight Electrode Holders. Up to 35% less in weight, they not only give excellent, but tireless performance. With Jackson's high-impact, high-heat resistant insulation, they also give you long trouble-free service, easy low-cost maintenance.

Featherlight

Medium-class streamlined model JH-3, 15-3/4 ounces, takes 1/4" rods into the tight spots at 300 amperes.

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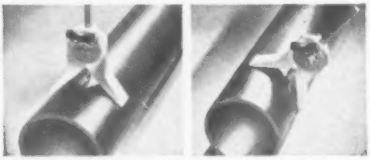

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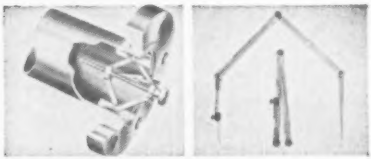

ALIGN PIPE AND FLANGE (slip on, lap joint, stub-end & welding neck) with this expanding tool.

MARK ANY ARC or circle up to 48" with this folding, all metal 24" Radius Marker.

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Industry & Welding

SEPTEMBER, 1956

VOL. 29 No. 9

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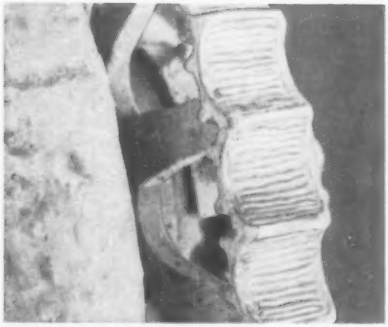

INTERMITTENT PASS used in hardsurfacing sprocket reduces rebuilding time and alleviates grinding by sand and mud.

TRACTOR IDLER shows herring-bone pattern created by intermittent pass. Grind and wear is reduced by this method.

Welder Develops Hardsurfacing Shortcut Using RANITE and Intermittent Pass

IN LOOKING for a more economical and quicker way to hardsurface tractor sprockets and idlers, Welding Foreman Art Powell of the L. E. Webb Construction Co., Inc., Santa Maria, Calif., hit on the idea of applying Ranite metallic coated hardsurfacing materials with an intermittent pass. In using this technique Powell lays down alternating beads with a gap between.

After trying other methods, Powell found this combination required less rebuilding time and at the same time effected a substantial dollar saving on each job.

ART POWELL, welding foreman for L. E. Webb Construction Co., Inc., long-time Ranite user, combined Ranite with intermittent pass to reduce hardsurfacing time.

Tractors of the Webb Construction Co. operate in both loose sand and mud with parts subject to continual heavy abrasion. When an intermittent pass is used on sprockets and idlers, resulting gaps formed between beads provide escape channels for the sand and mud, reducing grind and wear.

Although the Webb Construction Co. has been a Ranite user for more than two years, this is the first time Ranite was used for tractor maintenance and applied with an intermittent pass. Both Ranite "A" 3/16 and "B" 3/16 are being used for this purpose. Ranite was selected for its fast deposition rate, its resulting smooth weld bead and because it will not work harden.

Prior to shifting to Ranite, rollers were either sent out for rebuilding by automatic or were replaced with new ones. Actual savings now produced by using Ranite over automatic is $6 per roller with savings on sprockets and idlers totalling more than half previous costs. In addition, Webb Construction Co. has reduced actual hardsurfacing time by 50 per cent with the Ranite and intermittent pass combination.

Original parts used by them have a normal life expectancy of between 2000 and 3000 hours. Indications of Ranite hardsurfaced parts checked at 1000 hours of use are that the service span will be increased as much as three times.

Ranite, manufactured by Rankin Manufacturing Co., is the original metallic coated hardsurfacing rod in use throughout industry since 1938. It is made in several grades with a rod available to fit any hardsurfacing job. Toughness in proper relation to hardness is the answer to any wear problem and Ranite is alloyed on this principle with each grade being proportioned to give maximum wear for the job it is designed to do.

Cut your hardsurfacing time and costs now by shifting to Ranite. There's a Ranite rod for your application. For further information see your Ranite distributor or write to

RANKIN MANUFACTURING CO.
Dept. W-2, 616 South Marengo Ave.
Alhambra 2, Calif.

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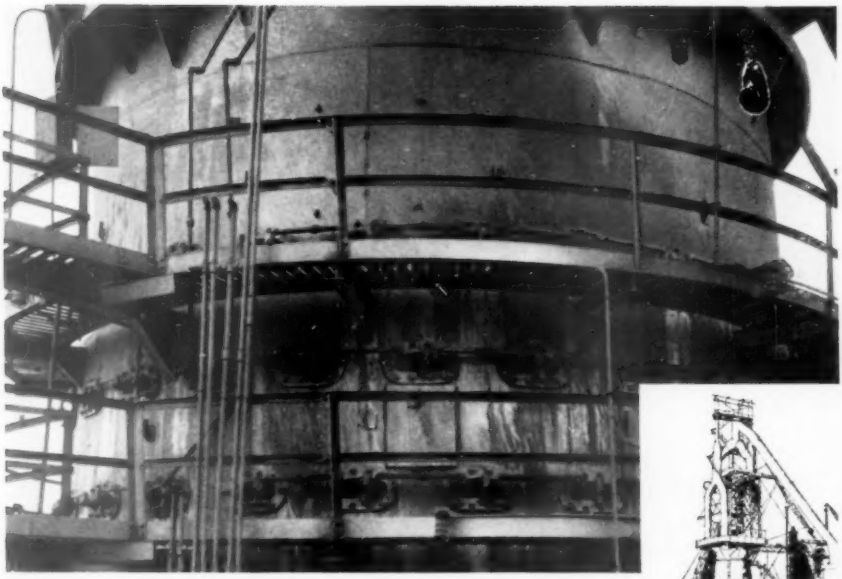

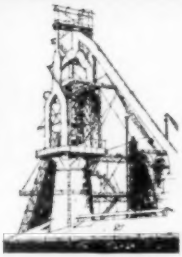

Why Airco 78E electrodes were selected to weld blast furnace "R"

A large eastern steel producer planned to build the giant blast furnace designated "R". Welding—with its obvious advantages of speed and economy—was naturally selected as the best method of construction.

But—which electrode would best do the job? These were the factors involved in making a decision:

(1) Quality of weld deposit. Welds had to be leakproof to contain the 15 psi pressure in the vessel. (2) High ductility and tensile strength were of prime consideration. (3) An all-position electrode was absolutely essential.

The Airco 78E electrode answered all these qualifications. Therefore, it was the logical choice. A total of 13,500 pounds of Airco 78E electrodes were used to weld the structure.

In building a blast furnace—or rebuilding an engine housing—Airco's Electrode Pocket Guide can help you take the guess work out of selecting the right electrode for the job. This 44-page booklet contains neatly condensed descriptions, applications and procedures—plus charts and graphs—for using the complete Airco line of electrodes.

It's free. Write Airco, at the address below. Request Catalog 1318.

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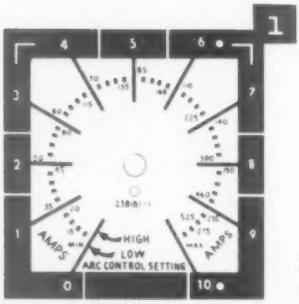


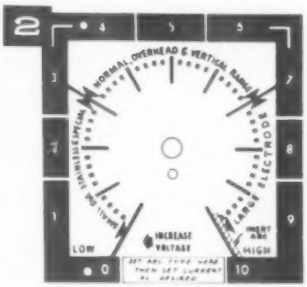
ARC CONTROL

1 SELECTION OF ARC TYPE

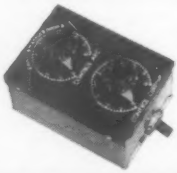
required for vastly different welding jobs, and adjustment necessary to suit the individuality of the operator and the welding job.

DUAL CONTINUOUS CONTROL

in a rectifier machine. Can vary the current from minimum to maximum, and vary the type of arc, in continuous stepless self-indicating dials.



CURRENT CONTROL



3 REMOTE CONTROL

of both these functions in a handy box that plugs into the front of the welder can save floor space by mounting welder out of precious production area.

for heavy continuous production jobs — this welder can TAKE IT!

PLUS these additional optional exclusive features:

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Both single and double bend types can be supplied with fluted cooling holes and water tubes bent in place*, to assure highly efficient cooling right up to the welding face.

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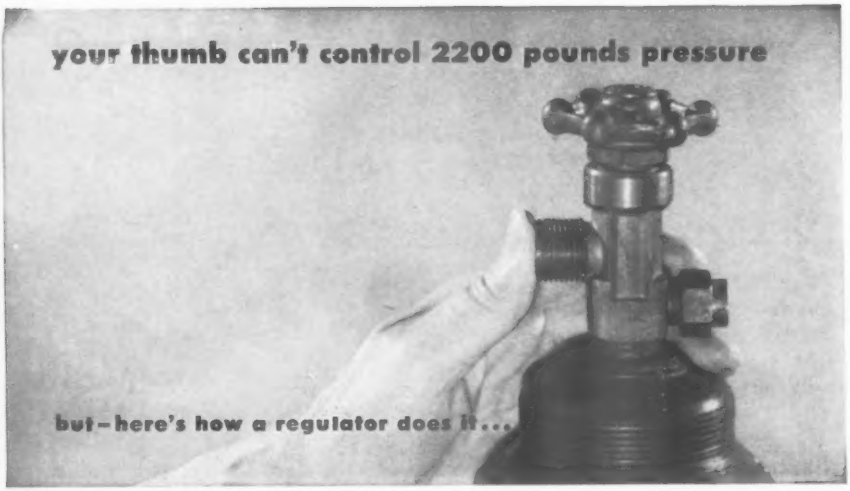

here are some of the interesting questions this book answers about regulators

How do regulators work — what is the difference between a single and a two stage reduction regulator — how does a gauge differ from a flowmeter—why are some regulators hard to adjust—what is a line regulator — what modern safety protection should a good regulator possess — what does the regulator inlet filter do — are big springs and large diameter diaphragms an advantage — how should one order a regulator

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518 H

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P&H Welding Positioners give you

EXTRA CAPACITY

for BIGGER PRODUCTION SAVINGS

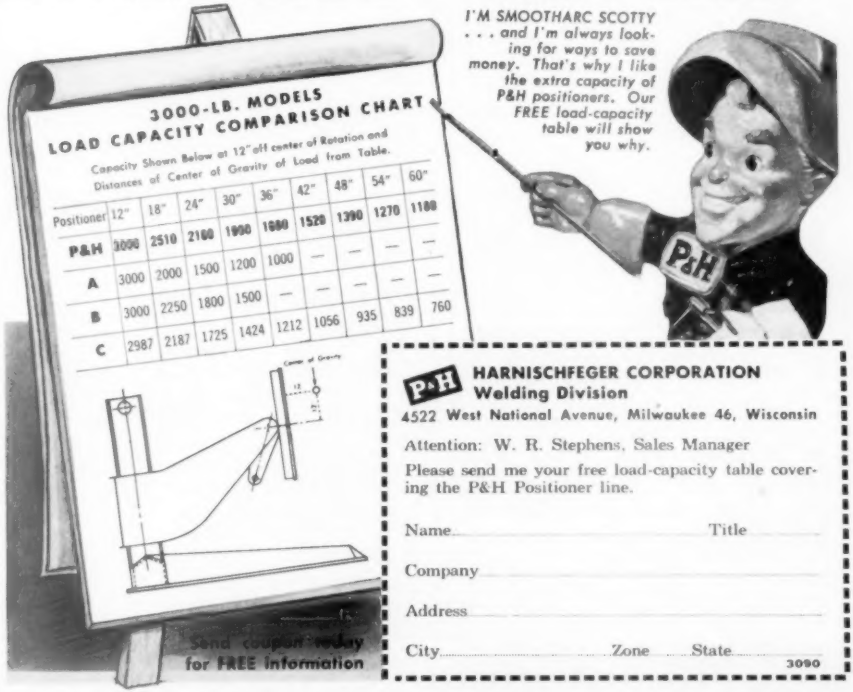
. . . exclusive P&H design features permit handling greater positioning loads for every dollar you invest

Positioned welding is *downhand* welding that permits your weldors to use larger, hotter rods for higher deposition rates. This extra welding speed and the savings in handling of weldments cut welding costs as much as 50%.

When economies like this are possible, it pays to get P&H positioners. Size for size, they can handle the widest range of weldments — give you the greatest capacity per dollar invested. The chart below compares the load capacities of positioners in the 3000-lb. class and proves the extra value of P&H.

This extra-capacity advantage is found in all sizes of P&H positioners. A free load-capacity table is available to help you select the model best suited to your needs. Just send in the coupon.

HARNISCHFEGER
MILWAUKEE 46, WISCONSIN


3000-LB. MODELS
LOAD CAPACITY COMPARISON CHART
Capacity Shown Below at 12" off center of Rotation and Distances of Center of Gravity of Load from Table.
Positioner 12" 18" 24" 30" 36" 42" 48" 54" 60"
P&H 3000 2510 2100 1900 1680 1520 1390 1270 1180
A 3000 2000 1500 1200 1000 — — — —
B 3000 2250 1800 1500 — — — — —
C 2987 2187 1725 1424 1212 1056 935 839 760
I'M SMOOTHARC SCOTTY . . . and I'm always looking for ways to save money. That's why I like the extra capacity of P&H positioners. Our FREE load-capacity table will show you why.
P&H
Send coupon today for FREE information

P&H **HARNISCHFEGER CORPORATION**
Welding Division
4522 West National Avenue, Milwaukee 46, Wisconsin

Attention: W. R. Stephens, Sales Manager

Please send me your free load-capacity table covering the P&H Positioner line.

Name..... Title.....

Company.....

Address.....

City..... Zone..... State.....

3090

P&H welding equipment is manufactured and sold in Canada by REGENT EQUIPMENT MANUFACTURING COMPANY LTD., 455 King Street West • Toronto, Ontario, Canada

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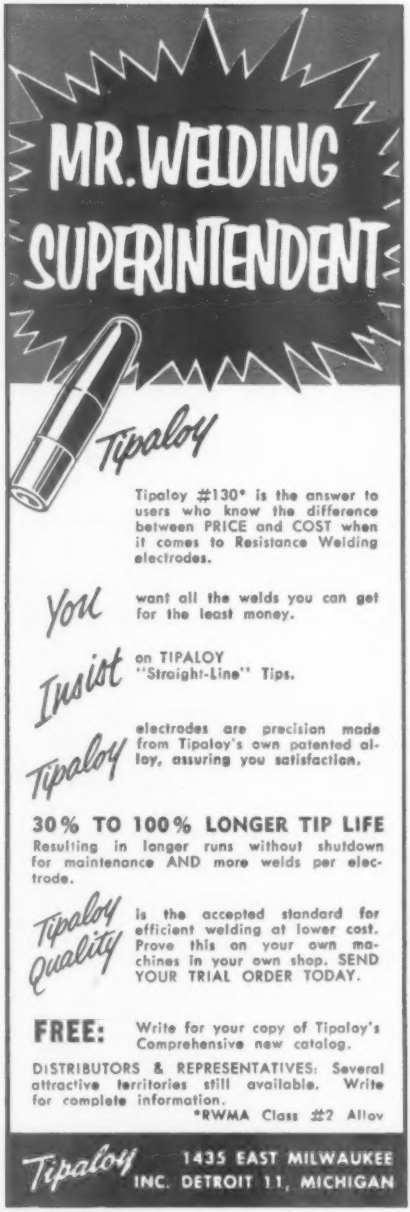
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Tipaloy #130* is the answer to users who know the difference between PRICE and COST when it comes to Resistance Welding electrodes.
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Resulting in longer runs without shutdown for maintenance AND more welds per electrode.
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1435 EAST MILWAUKEE
DETROIT 11, MICHIGAN

Circle No. 11 on Reader Service Card.

LETTERS TO THE EDITOR

Delayed Action Order

Gentlemen:

Thought it might be interesting for you to learn that we just received an order from the F. L. Smithe Machine Co. for one of our welding platens. If you will recall, way back in November, 1954, you called to our attention the fact that their Mr. E. S. Steeves wrote to you calling to your attention the fact that he never received an answer to an inquiry that he had sent us.

This only serves as an example that some of these inquiries, though they appear to be dormant, develop into actual orders.

Saul Volchok
Acorn Iron & Supply Co.

We are certainly proud of this pat on the back.

Electrode Holder Inquiry

Gentlemen:

Your July 1955 issue of INDUSTRY & WELDING makes reference to a new electrode holder marketed by American Welding Specialties, Inc.

This holder is known as "Kulite". The reference given is #99 on the Reader Service Card.

Will you kindly have descriptive data and price sent to us by this company. Thank you.

L. J. Anderson
Metal and Thermit Corp.

This request is typical of many we get from readers on new items.

(Turn to Page 14)

Circle No. 12 on Reader Service Card. →

HOBART

Automatic welding

. . . with constant voltage and SIMPLIFIED Controls

AUTOMATIC HEADS *available for:*

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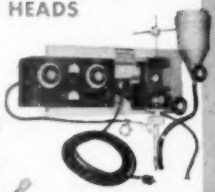
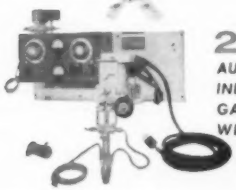
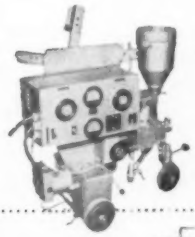




2. FULLY AUTOMATIC INERT GAS WELDING



3. TRACTOR TYPE AUTOMATIC ARC WELDER

4. SEMI-AUTOMATIC INERT GAS WELDING "MIGARC"

Hobart products known and depended upon throughout the world

Electric Motor Drive • Gas Engine Drive • Engine Drive with Auxiliary Power • D.C. Rectifiers • A.C. Transformers • A.C. Power–A.C. Welder Combination • D.C. Generator Only for Belting • A.C. Power–A.C. Welder Combination Generator Only for Belting • Fully Automatic Submerged Arc • Semi-automatic Welding Gas Migarc • Semi-automatic Submerged Arc • Self Propelled Gas Engine Drive • Carbonair Cutting and Gouging

. . . brings increased production and LOWER COSTS!

Many new advantages are now available in Hobart's "POWROMATIC" Constant Voltage power with simplified controls. Eliminates complicated electronic controls. You'll be amazed how easy you can use this new automatic and semi-automatic welding to speed your work and cut costs. Even less experienced weldors can double output and produce uniform high quality welds. You cannot afford to overlook automatic welding now that it's truly simplified and so easy to install and use. No obligation, write for complete information –

HOBART BROTHERS COMPANY, Box HW-96 Troy, O. Phone 21223.

See this equipment demonstrated at the **METAL SHOW** Oct. 8 thru 12 Space 2541 Tower exhibition hall

HOBART TROY OHIO WELDERS

"One of the world's largest builders of arc welding equipment"

HOBART BROTHERS COMPANY
BOX HW-96, TROY, OHIO

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_____ type automatic welding.

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"I like Airco 78E Electrodes because slag is so easy to remove"

Easy slag removal is just one of the many advantages of Airco 78E electrodes. This deep penetrating, all position electrode produces high quality weld metal which sets up rapidly. It is free from porosity, even when welding in the vertical down position. Especially recommended for welding mild steel where high ductility and tensile strength are essential.

This is but one of many electrodes in Airco's complete line that also includes stainless steel, hard-facing, cast iron, general and special purpose electrodes. Send for the free Airco Electrode Guide which will help you select the right electrode for your specific job. Request catalog 1318-IW.

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Air Reduction Canada Limited

Circle No. 13 on Reader Service Card.

LETTERS TO THE EDITOR . . .

(Continued from Page 12)

Resistance Welding on Cruise

Gentlemen:

I should like to acquire for the Caribbean Commission Library two copies of the article which appeared on page 65 of your October 1954 issue entitled "Resistance Welding Joins Dissimilar Metals".

David K. Easton
Librarian

Always happy to comply with the many requests we receive from educational institutions the world over.

Design For Arc Welding

Gentlemen:

We were very interested to read the article which appeared in your January, 1956 issue, entitled "Design for Arc Welding". Would it be possible for you to send three additional copies of this article to us.

R. W. Sharp, District Manager
Lincoln Electric Co.

Additional copies have been sent.

Welding Chrome Moly Steel

Gentlemen:

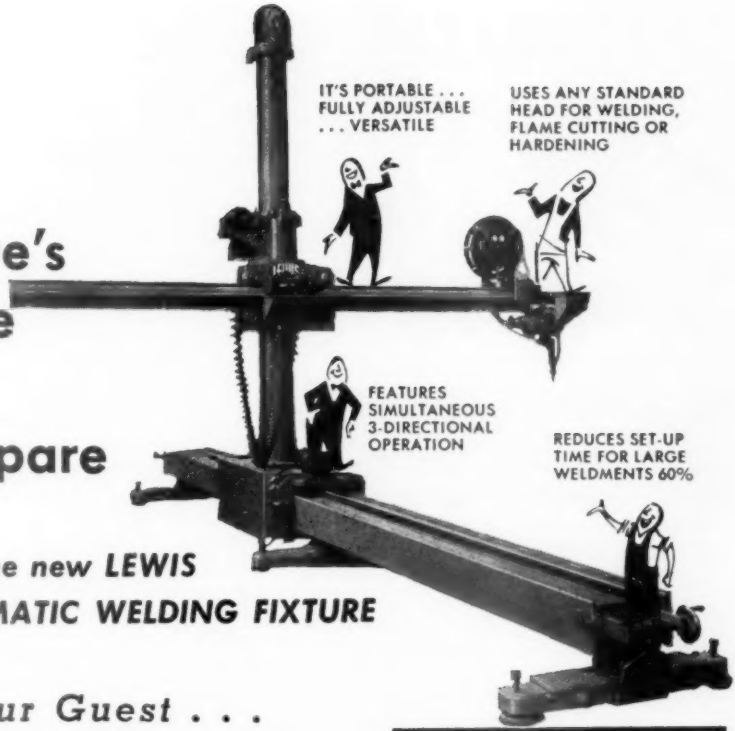
We recently ran across a brief abstract of an article which appeared in the November issue of INDUSTRY & WELDING.

We would like to request two reprints (if available) of the article entitled "New Method Solves Problems in Chrome Moly Welding". Thank you.

Robert Wawrousek
Assistant Metallurgist

They are and we have—(available and sent, that is).

(Turn to Page 16)


IT'S PORTABLE . . . FULLY ADJUSTABLE . . . VERSATILE
USES ANY STANDARD HEAD FOR WELDING, FLAME CUTTING OR HARDENING
FEATURES SIMULTANEOUS 3-DIRECTIONAL OPERATION
REDUCES SET-UP TIME FOR LARGE WELDMENTS 60%

There's none to compare

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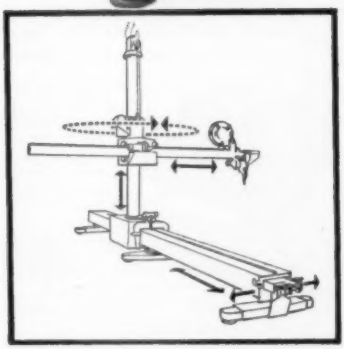
Be Our Guest . . .

WHEN YOU ARE IN CLEVELAND FOR THE METAL SHOW, OCT. 8-12!

See this versatile welding head manipulator in actual production in our Bedford plant. Transportation will be furnished. *WRITE OR CALL BEdford 2-2500 FOR DETAILS.*



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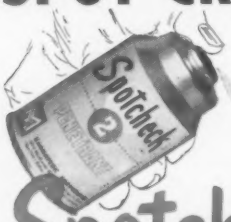
SPOT CRACKS with SPRAY ON Spotcheck®



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  Detects cracks in tools, parts, machinery.
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LETTERS TO THE EDITOR . . .

(Continued from Page 14)

Space Patrol Maintenance

Dear Mr. Gilbert:

In the January, 1956 edition of your excellent, compact INDUSTRY & WELDING magazine, under the section "New Books," a new publication entitled "Welding Between Planets" was described.

I would certainly appreciate having the address of the publisher so that I can obtain a copy.

L. F. Megow, General Manager
Fabricated Products Div.
Hahn & Clay

The address has been sent to Mr. Megow along with our thanks for the plug. This book was written by Clyde Clason, well known welding writer.

2 Times "Two Interesting Subjects"

Gentlemen:

Reading your "Letters to the Editor" column in the February, 1956 issue of INDUSTRY & WELDING, we are referring to the letter on page 36 entitled "Two Interesting Subjects."

We too are interested in receiving the articles mentioned in the letter as follows:

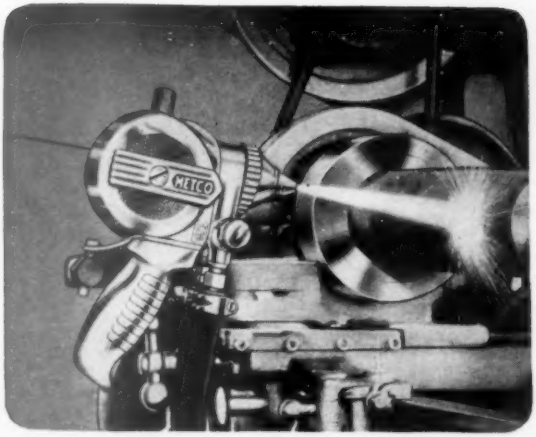
Carbon Dioxide — Will it Replace Argon and Helium for Inert Arc Welding? June, 1955.

Titanium Can Be Brazed and Soldered. June, 1955.

If at all possible, the forwarding of these articles to us would be greatly appreciated.

D. E. Armstrong, Mgr.
Speedline Division
Horace T. Potts Co.

We're happy to comply — again and again.



here's a really low-cost metallizing installation...

with the Metco L-Gun

Metallizing damaged journals on turbine shaft

Building up worn brake-drum

Metallizing protective coating on steel plate

New, low, compressed-air requirements... only 10 cfm at 40 to 60 psi, already available in many shops, or supplied by inexpensive 3 hp compressor... bring metallizing within reach of the small user.

Here's a chance for the smaller maintenance shop to get into profitable metallizing operations like these:

- Save up to 90% of replacement costs on machine repair jobs,
- Do your own hard-facing,
- Apply long-wearing corrosion-resistant coatings to exterior plant structures, tanks and other equipment.

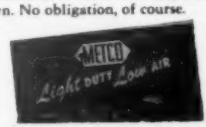
Sprays 23 Different Metallizing Wires—With the new L-Gun you can spray .10, .25, .80 carbon steels, stainless; babbitts, brass, bronze; nickel, aluminum, tin, zinc; special hard-facing materials such as Metco-Weld H, and the new self-bonding Sprabond wire.

It's Versatile—Use the L-Gun machine-mounted or hand-held—it weighs only 4 lb. 2 oz. Do all kinds of metallizing work—shaft and bore build-up with harder, longer wearing metals; build up worn pump plungers, crankshafts, motor shafts; apply corrosion-resistant coatings. There are hundreds of different jobs that are "naturals" for metallizing.*

Same High Quality as Other Metco Guns—The low air requirements of the new L-Gun have been achieved without any sacrifice in Metco quality. It embodies new developments in turbine and nozzle construction—is built, like all Metco guns, for rugged, dependable service.

A Real Opportunity for the Smaller Shop—Thousands of large, well-known companies have been metallizing users for many years, not only in maintenance but in production applications on original equipment. Now, with the development of the new L-Gun, and a low cost installation, metallizing is within the reach of even the smallest plant. (We'll be glad to send you the names of some Metco users—large and small.)

Free Bulletin or Shop Demonstration—Send off the coupon for the detailed information Bulletin 55 gives you. Or, better still, ask for a demonstration in your own shop by a Metco Field Engineer. He'll be glad to show you how the new Metco L-Gun works on some job of your own. No obligation, of course.



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1125 Prospect Ave., Westbury, L. I., New York • cable: METCO
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DON A. WATSON
METALLIZING ENGINEERING CO., INC.
1125 Prospect Ave., Westbury, Long Island, N. Y.

☐ Please send me more information about metallizing.
☐ Please arrange a demonstration in my shop.

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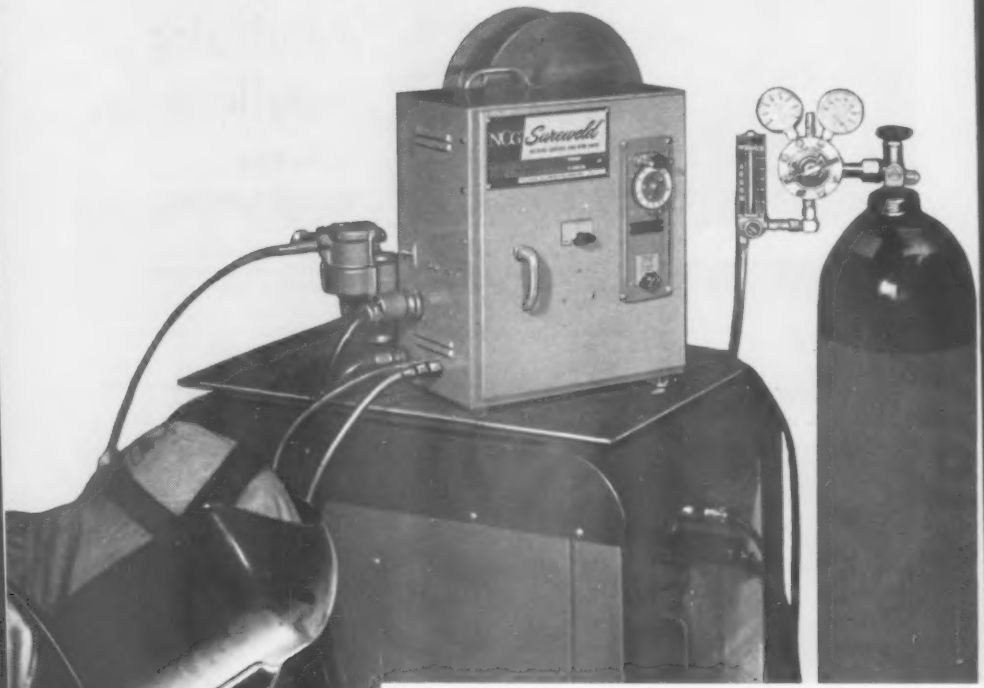
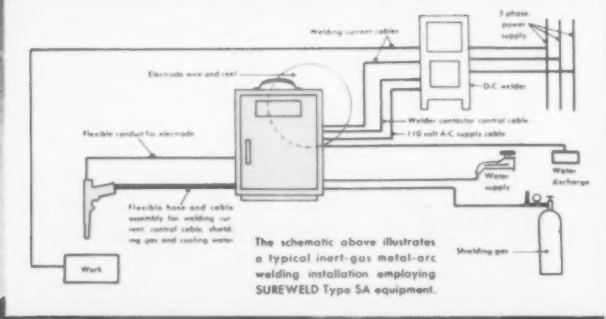
Circle No. 16 on Reader Service Card.

For CO_2 and inert-gas metal-arc welding with direct current

...the man with the gun




Welding current cables
3 phase power supply
Electrode wire and reel
D.C. welder
Welder contactor control cable
110 volt A.C. supply cable
Flexible conduit for electrode
Water supply
Water discharge
Flexible hose and cable assembly for welding current, control cable, shielding gas and cooling water
Shielding gas
Work

The schematic above illustrates a typical inert-gas metal-arc welding installation employing SUREWELD Type SA equipment.

VERSATILE . . . IN MAXIMUM DEGREE

welds better with SUREWELD®
semi-automatic welding equipment

Your welding operator is free to focus on the direction and the perfection of the weld—when he has new SUREWELD SA Semi-Automatic Welding Equipment.

It's *automatic* . . . the nearest thing to complete automation. Electrode feeds in automatically; that means better control of weld deposit. Gas feeds in automatically; that means maximum arc stability and lowest gas consumption. Water "feeds in" automatically—for proper cooling of the torch head under varying loads. Electrode length is automatically controlled at the conclusion of the weld and *that* means the proper electrode length needed for re-striking the arc.

The basic SA outfit is for manual semi-automatic welding and consists of electronic welding control and electrode drive, welding gun, and interconnecting gas and water cable assemblies. Conversion kits enable you to convert this equipment in minutes to fully automatic welding or arc-spot work.

SA equipment is designed for use with a constant voltage type DC power source. And for best results of all, it should be teamed-up with the new SUREWELD DRCV constant voltage welder. Get all the facts about SA equipment, and new DRCV welders, too, from your nearest NCG office. Or, write for the complete illustrated bulletin NH-136.

NCG®

NATIONAL CYLINDER GAS COMPANY • 840 North Michigan Avenue, Chicago 11, Illinois
Branches and Dealers from Coast to Coast

SEMI-AUTOMATIC OUTFIT for manual welding, with control unit, gun and cable assemblies. Operator's controls are on gun for convenience.

AUTOMATIC OUTFIT has remote control station, automatic gun. Types available for short and long length welding or with arc-spot feature.

MANUAL GUN has built-in finger-tip controls for starting and stopping arc, inching wire, and adjusting wire feed speed.

Circle No. 17 on Reader Service Card.

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Eye Protection

AO 327A

Coverglas Goggles are *Engineered* to Fit Comfortably over Prescription Glasses

These Coverglas goggles take the problem out of eye protection for welders who wear prescription glasses OR prescription safety glasses — *with or without side shields.* No matter which type is worn directly over the eyes, the welder works with extra comfort when wearing an American Optical 327A goggle. And here's another important feature — the shape and size (57.8mm) of the lenses give your welders up to 20% more vision compared with other goggles of this type. Your nearest AO Safety Products Representative will be glad to prove it to you.

Quick Facts

- Bridge of high grade leather, quickly adjusted. For rigid bar bridge ask for 327B. For rigid adjustable bar bridge ask for 327R.
- Regular Noviweld lenses and cover lenses or Noviweld Hardened lenses in shades 3, 4, 5 and 6. Easily replaceable from rear (not front).
- Retaining ring easily inserted from rear — prevents lenses being forced out toward eye.
- Plastic cups are lightweight, fit snugly, don't conduct heat.
- Side shields are light-tight yet provide good ventilation.
- Headband is all-rubber, easily adjustable.

It's Adjustable AO 372-14 *Straightaway* Sound Protector

Manual adjustment knob permits wearer to control pressure as noise varies in intensity — a comfort feature. Elongated type protector — covers jawbone opening. Excellent for both low and high frequency noise levels. Durable Neoprene rubber covered metal spring type headband. Dielectric, vinyl sponge ear cups provide complete ear seal. Easily sterilized. Many other features. Write for literature.

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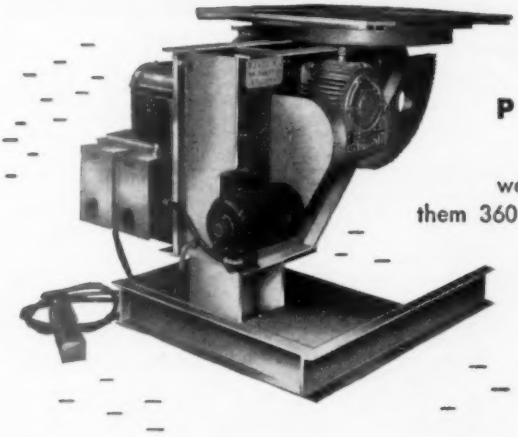
SOUTHBRIDGE, MASSACHUSETTS
BRANCHES IN PRINCIPAL CITIES

Always Insist on AO Trademarked Lenses and Frames.

Circle No. 18 on Reader Service Card.

POWERIZE YOUR WELDING JOB *FOR SPEED-PRECISION-SAFETY...*



PANDJIRIS POSITIONERS

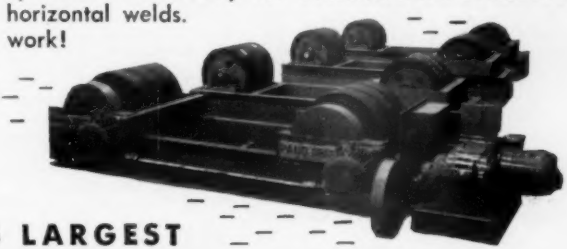
. . . POWER to tilt your weldments 135° and rotate them 360° for downhand welding. 3,000 lb. model shown.

Capacities up to 140,000 lbs.

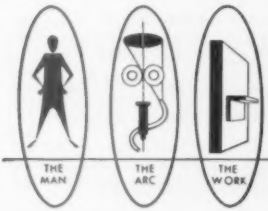
PANDJIRIS TURNING ROLLS

. . . POWER to turn cylinders continuously for circumferential seams . . . to position them for horizontal welds. No crane or manual work! Pandjiris builds 'em right . . .

Capacities up to 400,000 lbs.



THE WORLD'S LARGEST MANUFACTURERS OF "AUTO-WELD-MATONS"



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pandjiris weldment co.

DESIGNERS AND MANUFACTURERS OF PRODUCTION WELDING EQUIPMENT

5151 NORTHRUP AVE., ST. LOUIS 10, MO., U. S. A.

efficient positioning of all three

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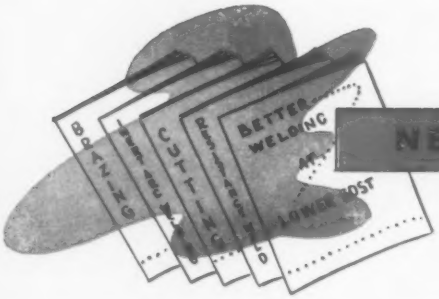


The publications featured on these pages were written by experts. They are FREE to our readers. To obtain these helpful reference materials use postcard bound into this issue.

HOW TO CHOOSE FLUXES FOR SOLDERING is explained in a new folder offered by Anchor Metal Co., Inc. Detailed information is given in Catalog 56C in two main sections. The first lists rosin-type fluxes for electrical and electronic joining that require non-corrosive flux residues and acid-type fluxes for general all-purpose soldering requiring strong flux action to remove surface oxides. **Circle No. 100 on Reader Service Card.**

"BRONZE WELDING, MODERN TOOL OF INDUSTRY," is an effective and useful presentation by the Bridgeport Brass Company. Brochure has tables showing melting points, melting point ranges, heat color scales, weights of brazing rod. Variety of rods are listed and described. **Circle No. 62 on Card.**

"WHO'S SELLING WHO?" is the title of an unusual new sales-management brochure now available to sales executives from Cappel, MacDonald & Co. It is a new attack on an old sales problem—getting men to sell. **Circle No. 101 on Reader Service Card.**

PROTECTIVE CLOTHING AND SAFETY EQUIPMENT FOR WELDING are featured in complete catalog and price list offered by Aljay Mfg. Co., Inc. Described in detail and illustrated are leather clothing and gloves and welding curtains. **Circle No. 92 on Reader Service Card.**

32-PAGE CATALOG ON CLAMPS is available from the Adjustable Clamp Company. Colorful book lists and describes over 40 styles of "C" clamps, bar clamps, handscrews, press screws and similar tools. Contains as well, much information on the proper selection, care and use of clamps. **Circle No. 78 on Reader Service Card.**

LIGHT, PORTABLE FLAME CUTTING AND PIPE BEVELING MACHINE is described in detail in a new brochure prepared by H & M Pipe Beveling Machine Co. Colorful literature shows many applications, and outlines the unusual features of the machine. **Circle No. 74 on Reader Service Card.**

EVERYTHING BRASS AND BRONZE, including welding rod and coiled wire, is featured in 20-page pocket-size booklet from Titan Metal Mfg. Co. Weight tables, specifications and other technical data is listed in handy form for all brass rod mill products made by the company. **Circle No. 55 on Reader Service Card.**

CUTTING TOOLS . . . New 12-page catalog 601 by M. A. Ford Mfg. Co. Inc., is organized for easy reference to a complete line of high speed steel and carbide rotary files and cutters, end mills and special tools.
tools. **Circle No. 102 on Reader Service Card.**

LATEST ELECTRODE HOLDER to be manufactured by H. J. Wagner Products, Inc., is described in their latest bulletin. Easily inserted in a shop note book, bulletin contains detailed specifications, price schedule, and replacement parts list. **Circle No. 103 on Reader Service Card.**

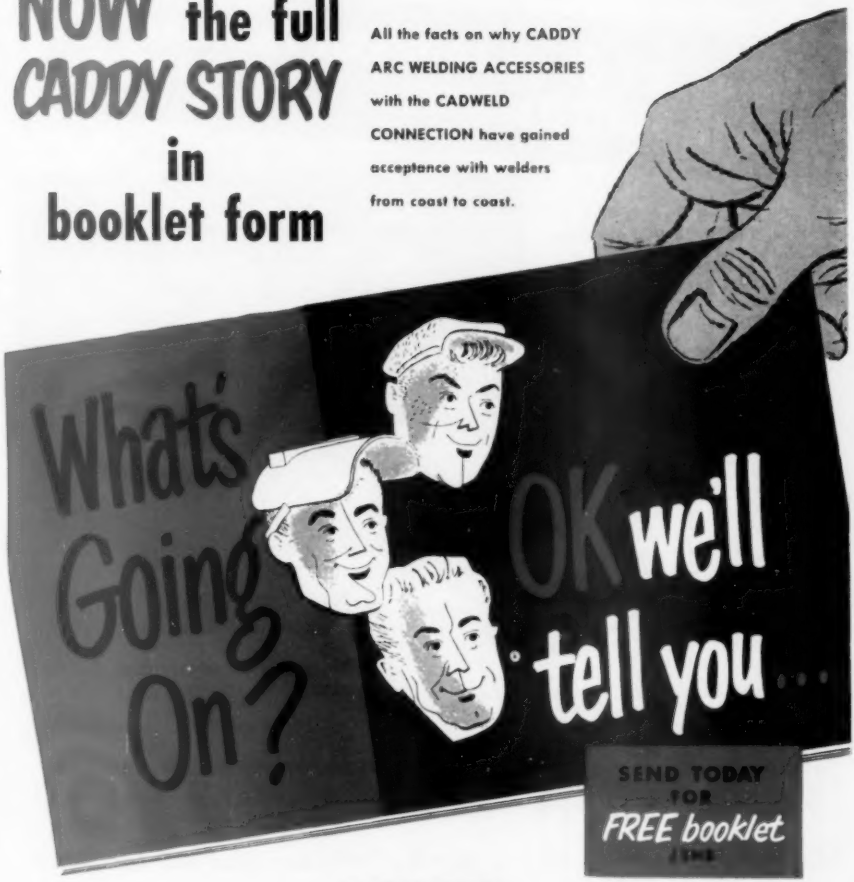
GRINDING WHEEL SAFETY is covered in a 36-page booklet entitled "Mounted Wheels" issued by the Grinding Wheel Institute. Eight maximum speed tables are included. **Circle No. 104 on Reader Service Card.**

VERSATILE SOLDERING AND BRAZING TORCH is introduced in literature from Huber Industries, Inc. Unit is described as being made of brass, except for stainless steel and conical valve system and form-fitting wooden handle. Unit has nine different tips and can be fitted with soldering iron tip. **Circle No. 105 on Reader Service Card.**

(Turn to Page 25)

NOW the full CADDY STORY in booklet form

All the facts on why CADDY ARC WELDING ACCESSORIES with the CADWELD CONNECTION have gained acceptance with welders from coast to coast.



LEARN:

1. Why CADDY ELECTRODE HOLDERS—RUN COOLER, ARE LIGHTER, ARE MORE FULLY INSULATED.
2. How CADWELD CONNECTIONS are made.
3. The principal behind the CADDY ARC WELDING CIRCUIT—"a solid copper circuit from welding machine to electrode".
4. The 6 MAIN FEATURES of the CADDY TYPE "B" fully insulated electrode holder.
5. What CADDY has over all competition.

CADDY®
ARC WELDING ACCESSORY DIV.

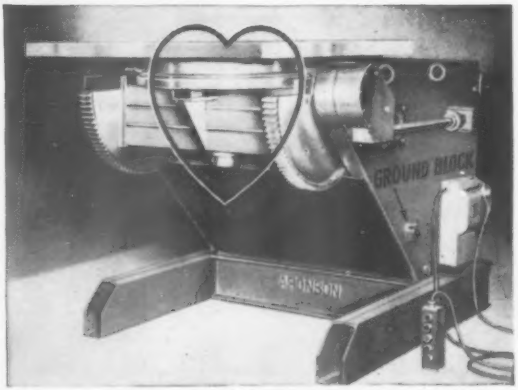
Erico Products, Inc.
2070 E. 61st Place • Cleveland 3, Ohio
Distributed in Canada by CANADIAN GENERAL ELECTRIC

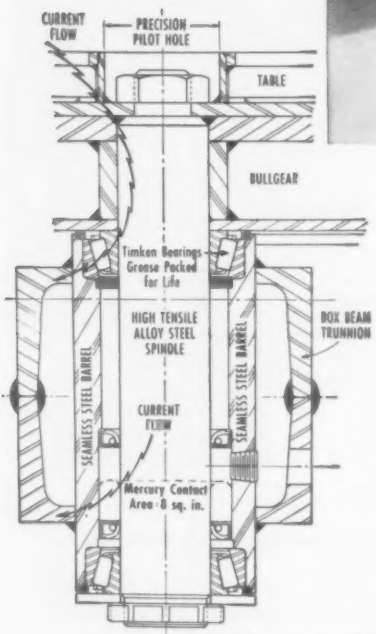
Circle No. 20 on Reader Service Card.

The HEART of an ARONSON Positioner with BUILT-IN MERCURY GROUNDING

With ARONSON you get this
PLUS FEATURE
at NO Extra Charge:

2000 Amps. minimum
Return Current
SURE Conduction.





- **Not a gadget *extra* attachment.**
- **Nothing to wear out. Nothing to service.**

If your welds are erratic, chances are your ground circuit is at fault.

ARONSON has over 200 STANDARD Models in TEN different types of Welding Positioners to choose from. You can be *sure* ARONSON POSITIONING supplies what you need to make the best welds at the lowest cost.

Call your nearby ARONSON DEALER, or write the factory.

another *Quality* POSITIONER by **Aronson MACHINE COMPANY**
ARCADE, NEW YORK

Circle No. 21 on Reader Service Card.

PIPE WELDING LAYOUT TOOL which increases speed and efficiency of layout operations is described in literature from Contour Marker Corp. Booklet describes how tool can be used to layout pipe joints, mark center lines, align pipe and flange and mark any arc or circle. **Circle No. 106 on Reader Card.**

SNAGGING WHEELS FOR PORTABLE GRINDERS and how they permit fast stock removal at low cost is the story told in a 4-page, two-color folder from Allison Company. Straight and cup-type wheels are featured and complete charts gives general specifications for portable snagging on all metals. **Circle No. 107 on Reader Service Card.**

HOW TO SLASH FLAME CUTTING COSTS with their new line of Silver Star cutting torches is explained in literature from Smith Welding Equipment Corp. Described and illustrated are machine and hand cutting torches, both with patented slip-in cutting tips. **Circle No. 34 on Service Card.**

"WHAT IS WELDING ENGINEERING" is the subject of a brochure prepared by the Department of Welding Engineering The Ohio State University. Brochure cites tremendous growth in welding that has amplified the need for more trained personnel. Facilities and courses at OSU are also included. **Circle No. 108 on Reader Service Card.**

BENDING BLOCKS AND WELDING PLATENS and the accessories that go with them are shown in an illustrated bulletin prepared by Acorn Iron & Supply Company. Includes detailed specifications. **Circle No. 91 on Reader Service Card.**

CHOOSING THE RIGHT POSITIONER OR TURNING ROLLS for specific jobs is made easy, according to the Aronson Machine Company. In an interesting technical bulletin, the company describes by means of photographs ad simple diagrams the function of different categories of equipment. **Circle No. 21 on Reader Service Card.**

ARC WELDING AND POWER SUPPLY CABLE is the subject of a data-packed bulletin from the Uniflex Cable Division, United Metal Craft Co. Specifications, voltage and current capacities and instruction details are given. **Circle No. 109.**

INVERSE-TYPE OXYGEN AND ACETYLENE REGULATORS introduced by Air Reduction Co. International are designed to meet needs of smaller shops where initial costs are a factor. Low-priced units of the Series 8000 are compact in design and light in weight. **Circle No. 110.**

PLATE LIFTING CLAMPS are described in a colorfully illustrated folder prepared by the manufacturer, Merrill Brothers. Many applications and advantages are cited, and the numerous specifications are discussed in detail. **Circle No. 47 on Reader Service Card.**

METAL PARTS FOR PROJECTION, SPOT AND ARC WELDING are listed for easy reference in stock parts list from Ohio Nut & Bolt Co. Described and illustrated are screws, pins, and nuts for all application. Ask for Bulletin 561. **Circle No. 111 on Reader Service Card.**

VERSATILE SHEET METAL CUTTER FOR UNUSUAL SHAPES. Case histories on how problems were licked with this machine are covered in an interesting booklet by the American Pullmax Company, Inc. **Circle No. 112 on Card.**

WIRE ROPE SLINGS, WHAT THEY ARE AND HOW TO USE THEM is the story told in new 4-page Bulletin DH-532A issued by the Wire Rope Sling Department, American Chain & Cable Co., Inc. Described and illustrated are wide variety and styles of wire rope slings, including vertical, basket, bridle or choker hitch. **Circle No. 113 on Reader Service Card.**

HOW STANDARD POSITIONING UNITS LOWER WELDING COSTS is the title of a magazine article reprint offered by C. B. Herrick Mfg. Corp. Complete line of standard—and special—fixtures for automatic welding operations are described and illustrated. Typical set-ups are explained. **Circle No. 52 on Card.**

(Turn to Page 26)

GAS WELDING RODS for steel, bronze, brass, and cast iron are shown in a two-color, loose-leaf brochure available from Metal & Thermit Corp. Physical properties, chemical analysis, welding procedure, and useful welding data are included. **Circle No. 115 on Service Card.**

HOW PORTABLE EQUIPMENT UNDER-CARRIAGES CAN CARRY LOADS AND REPUTATIONS is described in a colorful bulletin by United Manufacturing Co. Available axle units and details of construction and workmanship are illustrated. **Circle No. 116 on Reader Service Card.**

ALL YOUR METAL MARKING NEEDS are cataloged in a bulletin offered by Whittaker, Clark & Daniels, Inc. Described and illustrated are crayons, soapstone and talc in three grades for us by welding operators and metalworkers. **Circle No. 89 on Reader Service Card.**

LOW-HYDROGEN, POWDERED-METAL ELECTRODES. Bulletin GED-3048 prepared by General Electric Company gives four pages of features, deposition rates and properties of Strikeasy LH-1 and LH-2. According to G.E. the new electrodes give faster welding than conventional low-hydrogen electrodes but equal them in deposit quality. **Circle No. 118 on Reader Service Card.**

NONDESTRUCTIVE TESTING AS A PRODUCTION TOOL. Prepared by the Magnaflux Corporation, this interesting booklet discusses various uses for testing, and is said to show how a nondestructive testing program can be instituted as a money-saving tool. **Circle No. 15 on Reader Service Card.**

FACE SAVING CATALOG indexed for eye appeal and ordering ease shows a complete line of eye, face and head safety products manufactured by Glendale Optical Co., Inc. Attractively illustrated, this handy book lists all types of goggles, face shields, helmets, plastic eyeshields, as-well-as, replacement plates and lenses. **Circle No. 120 on Reader Service Card.**

NEW AIR-OPERATED TOGGLE CLAMPS can provide split second clamping in multiple or single unit use if they're the new model 810, claims Detroit Stamping Co. New, illustrated bulletin gives styles, sizes, operating characteristics and life expectancy. **Circle No. 121.**

HOW TO GET COOL, SMOOTH GRINDS ON STAINLESS ALLOYS is the subject of an informative folder made available by Manhatten Rubber Division, Raybestos-Manhatten, Inc. Typical applications and recommended wheel-types are given. **Circle No. 122 on Reader Service Card.**

POWER PRESS BRAKE DIES are effectively described in a 48-page wire bound manual prepared for plant and shop people by Cyril Bath Company. Includes many easy-to-use tables, drawings and other data. Also gives supplementary information on sheet, strip and plate gauges and weights. **Circle No. 123 on Reader Service Card.**

HANDY CATALOG OF MANGANESE-NICKEL-STEEL WELDING PRODUCTS prepared by the Taylor-Wharton Division clearly lists prices and stock sizes available. "Timang" products include rods, hot-rolled plates, special shapes, wedge bars, tooth repointers and applicator bars. **Circle No. 84 on Card.**

COMPLETE LINE OF WELD CHIPPING HAMMERS is featured in literature available from Atlas Welding Accessories, Inc. Described in detail are hammers with induction hardened heads and wooden or steel handles. **Circle No. 37 on Reader Service Card.**

HOW FLAME CUT-OFF EQUIPMENT CAN BOOST PRODUCTION is explained in a colorful booklet from Speedi-Burn Products Co. Featured are several versatile oxy-acetylene production cutting models for cut-off and mitre-beveling operations on bar stock and pipe. **Circle No. 124 on Service Card.**

"A FASCINATING STORY" is the title of a fact-filled folder offered by Shawinigan Products Corp. Booklet explains how company's carbide products give users "welded bliss." **Circle No. 82 on Reader Service Card.**

(Turn to Page 29)

save up to 50 minutes on 30′ welds

with magnetic plate clamps

ask your Bux dealer for a money-saving demonstration

You eliminate costly welding set-up time when you secure work pieces with efficient Bux magnetic plate clamps. No more clumsy, time-wasting clips, wedges or weights. Up to 6500 pounds of powerful electro magnetic pull positions and holds even heaviest plates while weld is made. Time saved in tacking, welding clamps and deburring cuts welding cost in half. Bux magnetic plate clamps are portable and rugged, can be used anywhere in the shop or field. Proven in thousands of uses in butt, lap, or warped plate welding—flat, vertical or curved pieces. Electro-magnetic power is controlled by positive action switch—flick on and full power is at work; flick off and magnet lets go instantly. There's no time wasting lag.

BUX

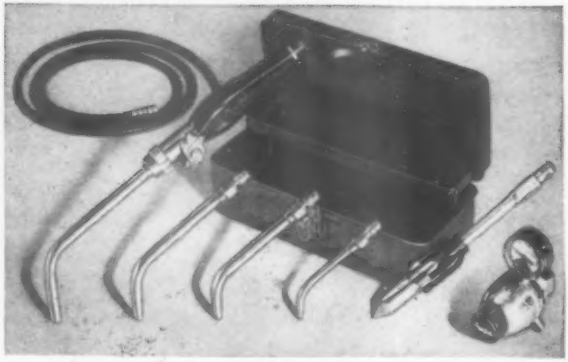
BUCK MFG. CO.
100 Roberts Road, Los Gatos, California

Circle No. 64 on Reader Service Card.

MAINTENANCE MEN! Solder • Heat • Braze

with the Prest-O-Lite Trade-Mark 5-in-1 OUTFIT

Outfit includes six-ft. length of fitted hose and fully adjustable gas pressure regulator for exact flame control.



This compact outfit easily handles all of the soldering, heating, and light brazing necessary in the maintenance and repair work in most buildings, plants, and factories. One handy kit with a flame for every job. Its four differently sized, open-flame stems and soldering iron are instantly interchangeable on one handle for any job from heavy heating to fine electrical soldering. Entire outfit is packed in a sturdy, steel carrying case and operates from small, portable tanks of acetylene. The torch handle has a shutoff valve and built-in pilot flame control for convenience and gas economy. Ask your LINDE jobber for a demonstration. Or write LINDE AIR PRODUCTS COMPANY, a Division of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y. In Canada: Linde Air Products Company, Division of Union Carbide Canada Limited, Toronto.

GET IT FROM YOUR LINDE JOBBER

The terms "Linde" and "Prest-O-Lite" are registered trade-marks of Union Carbide and Carbon Corporation.

Circle No. 23 on Reader Service Card.

NEW CONSOLE-TYPE PRECISION RESISTANCE WELDER is described in a 'modern' bulletin compiled by Unitek Corporation. Having greater stored energy capacity and higher electrode pressures than previously, Weldmatic Model 1020 is said to permit heavier production applications on "difficult" materials. **Circle No. 125 on Reader Service Card.**

NEW HARDSURFACING SHORTCUT is introduced in catalog from Rankin Mfg. Co. Described and illustrated is new technique which utilizes company's hardfacing alloys and intermittent pass welding. **Circle No. 5 on Reader Service Card.**

STAINLESS STEEL AUTOMATIC WELDING WIRES in every size and analyses are the subject of complete catalog offered by Crucible Steel Co. of America. Wire is available in spools or layer-wound coils. **Circle No. 164 on Card.**

GENERAL UTILITY AIR COMPRESSORS are the subject of a new bulletin available from American Brake Shoe Co. Well illustrated 4-page brochure carries information on 19 models of compressors running from 1/3 to 1¼ hp in the 125 to 150 psi range with various types of drives. **Circle No. 127 on Reader Service Card.**

NEW-LIFE FOR WORN EQUIPMENT is the subject of a colorful, 15-page Bulletin WA-77 prepared by American Manganese Steel Division, American Brake Shoe Company. Dimensions and data are given on repointers, grouser bars, filler bars and plate of long-wearing manganese steel, together with helpful hints for making repair jobs easier, faster and better. **Circle No. 40 on Card.**

"GRINDING AND POLISHING APPLIANCES WITH 3M COATED ABRASIVES" is a colorful 10-page booklet which features weld grinding and blending case histories and explains how they cut costs and improve finishes. Published by Minnesota Mining & Mfg. Co., booklet illustrates use of coated abrasives, including belts, sheets, discs and polishing and grinding wheels. **Circle No. 128 on Reader Service Card.**

"RECOMMENDED PRACTICE FOR THE WELDING OF STEEL CASTINGS" is a comprehensive forty page manual published by the Steel Founders Society of America and made available by the Tempil Corporation. Chock full of valuable information on "Welding Methods," "Electrodes" and "Recommended Welding Procedures for Carbon-Steel and Low-alloy Steel Castings," this manual is a "find." **Circle No. 129 on Reader Service Card.**

PORTABLE "TWIN SPOT" WELDING GUNS are the subject of a 4-page illustrated bulletin from Aro Spotwelder Division, Guthery Machine Tool Corp. Comprehensive folder gives design details, specifications and typical twin-spot welding practices. **Circle No. 130 on Card.**

INTERESTING WELDING ACTIVITIES are featured in Memco News, official publication of Miller Electric Manufacturing Company. Of special interest are pages 4 and 5 of the June-July issue which features Miller's brand new plant and facilities. **Circle No. 131 on Reader Service Card.**

IS YOUR WELDING PROBLEM OBROUND? If so, Sight Feed Generator Co. has a new Rexarc positioner and automatic welder which has been engineered to reduce production cost. Illustrated folder describes unit which has synchronized travel for welding of flat and curved sections at a constant speed. **Circle No. 132 on Reader Service Card.**

HOW "BUYER'S GUIDE TO SHEETS AND STRIP" HELPS ELIMINATE HIDDEN COSTS is explained in new, two-color bulletin from Joseph T. Ryerson & Son, Inc. Index to more than 20 kinds of stock, suggestions for best selection and facts on cutting and service facilities available are covered. **Circle No. 133.**

WELDING GLOVES AND WELDING MITTS are the subject of a handy 8-page folder which lists the company line made by Elliott Glove Co., Inc. Various glove-types are illustrated, design details given and prices listed. **Circle No. 134 on Reader Service Card.**

(Turn to Page 30)

HOLDERS . . . HOLDERS . . . HOLDERS . . . for all welding requirements are listed and pictured in handy loose-leaf form prepared by Jackson Products Co. Durably built for comfort and economy, these electrode holders are available in styles to suit individual requirements, according to the manufacturer. **Circle No. 1 on Reader Service Card.**

A FAST, RUGGED AND LIGHT WELD SCALING HAMMER is the subject of an illustrated 4-page folder available from Rotor Tool Co. Complete specifications and operating data are given for company's S-1 scaling hammer. **Circle No. 135 on Reader Service Card.**

TUBE SELECTION CHART listing 75 power rectifiers and control tubes is available from General Electric Tube Sales. Thyratron ratings and average control characteristics are listed in Bulletin ETD 1322 along with maximum ratings of classified ignitrons. **Circle No. 136 on Reader Service Card.**

THE HEAVIER THE LOAD . . . THE TIGHTER THE GRIP is a capsule description of a new steel grab introduced by Mine Safety Appliances Co. Bulletin No. 0902-1 gives design details for the grab and explains how it can be used to handle steel plate or structural forms up to 12,000 lbs. **Circle No. 137 on Reader Service Card.**

PRICELESS PRICE LIST FOR OXY-ACETYLENE HEATING, CUTTING AND WELDING torches, regulators and Gasaver parts and accessories is available from Weldit, Inc., in easy-to-use information and is easy-to-understand 12-page book. **Circle No. 4 on Reader Service Card.**

HEAT TREATMENT OF AIR HARDENING ALLOYS ON WELDING is the title of a 12-page pamphlet issued by Babcock & Wilcox Co. Bulletin TR-543 furnishes metallurgical data on the subject of postweld heat treatment and the influence of weld preheating temperature on hardness and structure of heat treated welds of air hardening alloys. **Circle No. 139 on Card.**

A PIPE CUTTER'S DREAM that makes all types of beveled cut-offs is the subject of Bulletin No. P-10 prepared by Vernon Tool Co., Ltd., on their pipe cutting pantograph. Advantages and features of two models of this "complete pipe shop" are thoroughly described and illustrated. **Circle No. 140 on Card.**

VERSATILE MACHINES FOR LOOKING THROUGH METALS are featured in a catalog from Budd Company. Four-page bulletin describes recently introduced line of gamma-projectors for use on weldments, fabricated parts and castings. Company claims units have significant advantages over conventional X-ray and other gamma-type ray equipment. **Circle No. 141 on Reader Service Card.**

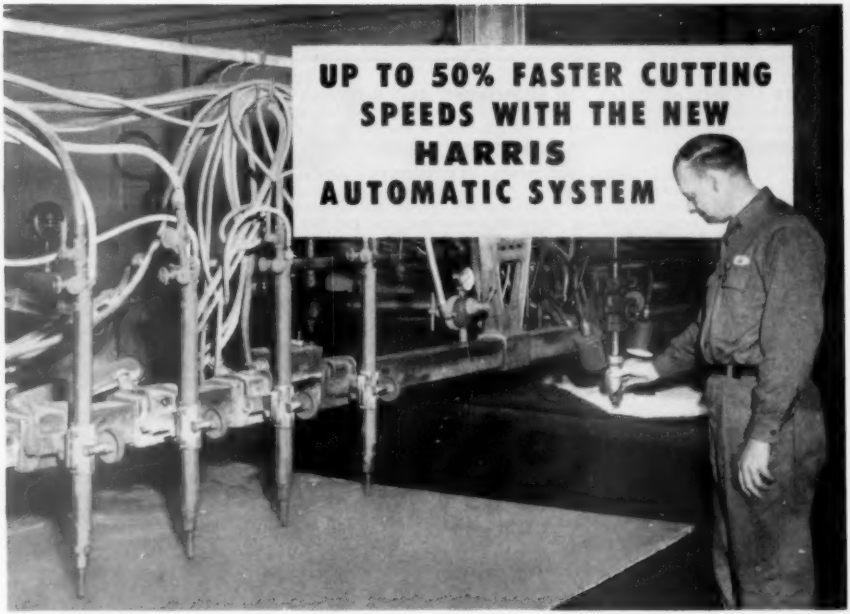
PRODUCTION BRAZING AND SOLDERING is the name of Bulletin S-1050 prepared by Selas Corporation of America. Step-by-step procedure for tailoring high production automatic brazing equipment to specific needs is amply described in colorful presentation. Illustrations show typical applications on a wide variety of metals. **Circle No. 142 on Reader Service Card.**

GRINDING WHEELS FOR WELD GRINDING AND FINISHING are among the abrasive products featured in a complete catalog from Norton Company. Catalog describes and illustrates company's complete line of abrasive products, boron carbide molded products, non-slip aggregates, refractory products and machinery. Abrasive papers and cloths and pressure-sensitive tapes made by company's Behr-Manning Division are also included. **Circle No. 143 on Reader Service Card.**

LATEST LITERATURE ON TORCHES, REGULATORS, WELDING, CUTTING AND SOLDERING OUTFITS AND ACCESSORIES is just off the press and available from Dockson Corporation. Complete data is given on design, materials, quality and replacement parts in this colorful bulletin. **Circle No. 144 on Card.**

INDIVIDUAL SLIP-OVERS FOR WORN SHOVEL TEETH and the ease with which they are applied is the story told in a 6-page brochure from Stultz-Sickles Co. Featured is economical Wing-Ding dipper tooth repointer cast from 11-14% manganese steel. **Circle No. 145 on Reader Service Card.**

(Turn to Page 32)



Now, with the new Harris system you can get faster cutting speeds than ever before. A flick of the wrist controls pre-heat oxygen pressures to as many as eight machine cutting torches simultaneously.

Write us today for further details, or call your nearest Harris distributor.

- ✓ Up to 50% faster cutting speeds over older methods.
- ✓ Up to 80% reduction in consumption of pre-heat oxygen. Overall oxygen consumed lowered as much as 20%.
- ✓ Slag removal reduced to a minimum.

HARRIS

HARRIS CALORIFIC CO.

5500 CASS AVENUE
CLEVELAND 2, OHIO

Circle No. 24 on Reader Service Card.

WIRE IN SPECIAL COILS FOR SUBMERGED ARC WELDING is cataloged for easy reference in brochure from Reid-Avery Co., Inc. Featured are mild, low alloy, stainless, straight chromium and special steel grades furnished thread wound on corrugated metal liners packed in cardboard cartons. **Circle No. 146 on Reader Service Card.**

RESISTANCE WELDING ELECTRODES, ACCESSORIES AND MATERIALS are covered completely in a 56-page catalog available from Weldaloy Products Company. Specifications are given for electrodes, wheels, holders and other products along with recommendations for their specification. **Circle No. 147 on Reader Service Card.**

OXY-ACETYLENE WELDING AND CUTTING EQUIPMENT is featured in the 1956 revision of No. 150 General Welding Catalog from Modern Engineering Co. Covered is complete line of torches, regulators, pressure gauges, hose connections, couplings and safety equipment. **Circle No. 148 on Reader Service Card.**

'OUT OF THIS WORLD' THIN WALL TUBE BENDER is described completely in colorful, profusely illustrated book now available from Wallace Supplies Mfg. Co. Bender makes all types of bends without requiring highly skilled operator, claims Wallace. Complete mechanical and electrical specs are included. **Circle No. 149 on Reader Service Card.**

COMPLETE LINE OF ELECTRIC CABLE VULCANIZERS is featured in new Bulletin B48a just released by Joy Mfg. Co. Described in detail are portable and stationary units, kit box ensembles, supplies and accessories. Bulletin has complete how-to-do-it section that tells how to repair cable and even rejacket air hose. **Circle No. 150 on Reader Service Card.**

3 IN 1 FILLER ROD FOR OXY-ACETYLENE BRAZING AND BRAZE-WELDING is the way Ampco Metal, Inc. describes their Ampco-Braz No. 1 in a new bulletin. Use in industry and small shops, characteristics, deposit properties, specification data and sizes are covered. **Circle No. 151 on Service Card.**

(Turn to Page 34)

Alloys and Fluxes for SOLDERING FILLING SEALING ARC WELDING TORCH WELDING FURNACE BRAZING TORCH BRAZING

SWITCHED TO A-S No. 13

Company Processing Sugar Beets

They Switched to Nickel-Silver for Retreading with Wear-Resisting Build-Up Metal!

They spent **$23.74 more** for 100 lb. of Nickel-Silver . . . **saved $150.50** in other costs incident to repair of this one spindle. They repeated on 8 spindles. All-State No. 13 Nickel-Silver Build-Up Rod is now their standard for retreading.**

ALL-STATE No. 13 is Famous for Savings!

- **20 lb. saved replacement of a $1300.00** packing gland journal.
- **25 lb. saved $510.00** net on finely heat-treated gears.
- Hundreds other case histories of Savings.

10 lb. No. 13 will start saving money for you. Comes bare or flux-coated.

**Details on request

FREE ASK FOR BUYERS GUIDE. THIS IS A BOOK FULL OF PRODUCT SOLUTIONS TO METALWORKING PROBLEMS.

ALL-STATE WELDING ALLOYS CO., INC., WHITE PLAINS, N. Y.

Circle No. 25 on Reader Service Card.

Circle No. 26 on Reader Service Card. →

BRAZED SUCCESSFULLY WITH... SILVALOY

LOW TEMPERATURE SILVER BRAZING ALLOY

This is the trade mark of Brochu and Hass of Grand Rapids, Michigan—one of the more successful manufacturers in the field of forming and assembling stampings in steel, brass and aluminum for automotive, household appliance and specialty hardware manufacturers.

A COMPLETE GUIDE TO SELECTING FLUXING FOR LOW TEMPERATURE SILVER BRAZING
A COMPLETE GUIDE TO SUCCESSFUL SILVER BRAZING...
SILVALOY

These two complete reference manuals for low temperature silver brazing and fluxing are available upon request. Send for either one or both.

An efficient production schedule such as Brochu and Hass developed for this stamped oil reservoir assembly (an important component of an automotive hydraulic pump system) depends upon good, consistent performance of equipment, flux and brazing alloy.

After much experimentation, Brochu and Hass selected Silvaloy preformed silver brazing alloy rings and APW Black Flux "to insure perfect, strong joints and to avoid 'leakers' and costly re-brazing." With these materials, their specially built machine is capable of completing 300 to 400 units per hour.

Silvaloy Brazing Alloys and APW Fluxes are helping to speed production, lower costs and improve brazing results in many fields. Call the Silvaloy Distributor in your area for information or technical assistance. ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

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APW

ENGELHARD INDUSTRIES

POWER POSITIONING OF SMALL WELDING JOBS is described in a new, illustrated specification sheet which describes bench model welding positioner made by Worthington Corporation. **Circle No. 152 on Reader Service Card.**

SECRET OF STABLE DELIVERY PRESSURE IN A LOW COST REGULATOR is revealed in literature available from Liquid Carbonic Corp. Brochure describes in detail new "cartridge" control unit which is said to maintain absolutely constant delivery pressure from full to empty cylinder. Unit is said to give New Gasweld Series R-90 regulators two-stage performance at single-stage cost. **Circle No. 43 on Reader Service Card.**

SIMPLE STEPS TO INDESTRUCTIBLE CABLE CONNECTIONS is the way Cam-Lok Division of Empire Products Inc. describes their system of cable connections in an attractive loose-leaf folder. Safety, freedom from damage due to moisture, wear, reduced cable breakage and resistance to shatter are said to be available in the shop or in the field with portable kit and rubber insulated connections. **Circle No. 63 on Reader Service Card.**

X-RAY INSPECTION OF WELDMENTS AT BABCOCK & WILCOX is one of a dozen interesting articles appearing in "Radiation Digest," second quarter, 1956, published by X-Ray Department of General Electric Co. Publication describes the use of X-ray inspection in a variety of industries. **Circle No. 153 on Reader Service Card.**

PRECISION FLAME MACHINING OF LARGE SPROCKETS AND GEARS explained in new booklet just released by Seaman-Andwall Corporation. Automatic production of sprockets and gears to close tolerances with fast, rugged Cogmatic oxy-acetylene flame cutting unit is "duck soup" according to manufacturer. **Circle No. 154 on Reader Service Card.**

(Continued on Page 120)

the **ARC-TWIN** *Cuts Two Perfect Notches*
in *One* Downstroke of Press!

SAVING both time and cost, it gives you perfect T-joints — instantly ready for welding or brazing without deformation or finishing! Twin-acting punch shears clean, from inside out, leaving two matching notches (in perfect 180° alignment) with every downstroke of the punch press. Quickly interchangeable dies and punches accommodate pipe and tubing from ½" to 2⅛" O.D.; special units, up to 3" O.D.

Special Arc-Twins for double notching stainless steel or monel metal and units built to your specifications can also be furnished.

PATENTED

Ask for twin-notched sample of pipe or tubing

VOGEL TOOL AND DIE CORPORATION 1819 North 32nd Ave. Melrose Park, Illinois

Circle No. 27 on Reader Service Card.

Circle No. 28 on Reader Service Card. →

ENGELHARD INDUSTRIES

At Side-O-Matic Unloader Corp. and York-Shipley, Inc.

LOW-COST GENERAL ELECTRIC 295-AMP WELDERS PAY OFF ON TWO BIG-WELDER JOBS

Production welding applications at two manufacturing plants in York, Pennsylvania again show how low-cost G-E 295-amp AC general purpose welders deliver big-welder performance.

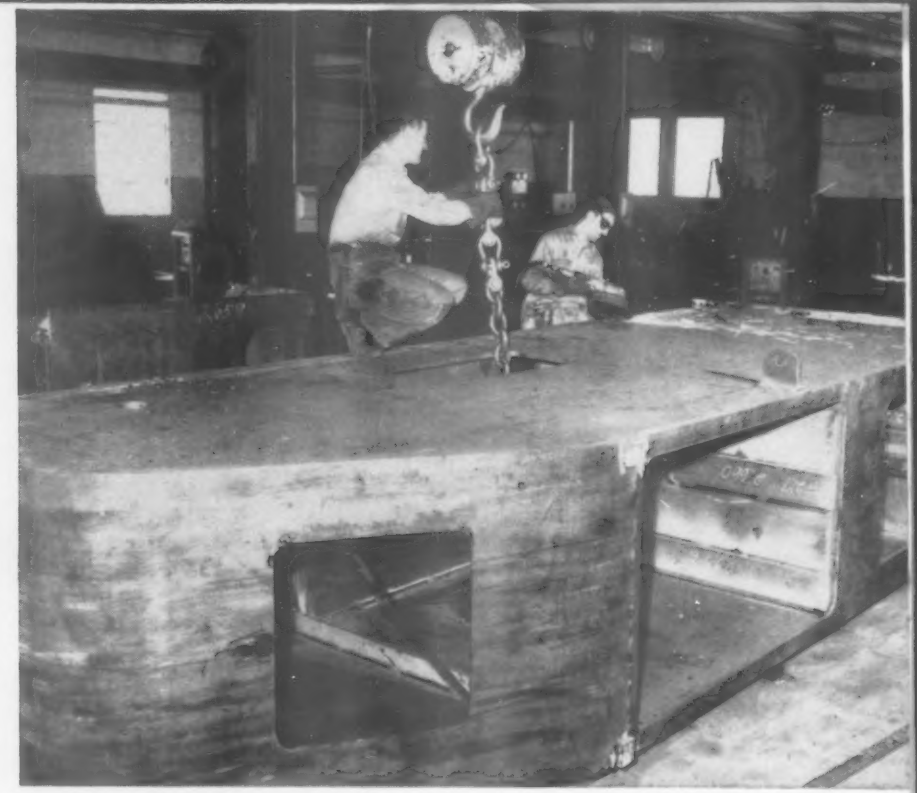
York-Shipley, Inc., a major manufacturer of heating and air conditioning equipment, uses G-E 295-amp AC welders in fabricating heating-unit generators for their oil and gas-fired residential furnaces.

Glenn C. Himes, production supervisor, reports, "In fabricating our heating-unit generators we have to use low-hydrogen electrodes to weld 'sandwiches' of mild aluminized and stainless steel. The high open-circuit voltage of the G-E welders lets us use low-hydrogen electrodes with almost complete freedom from popouts—something other machines we've tried couldn't do."

Side-O-Matic Unloader Corporation, manufacturers of truck-mounted concrete block unloaders which drastically reduce unloading time, uses G-E welders exclusively in its manufacturing process. Ralph Sheasley, shop supervisor for Side-O-Matic, says, "Our G-E 295-amp welders do a good job—under almost continuous operation. Fabricating our unloaders takes a variety of different welds on material as heavy as 8-inch channel. We get the high quality, strong welds we need with these G-E welders."

See for yourself how G-E 295-amp AC welders can do big-welder jobs. Contact your nearby General Electric Welding Distributor (He's listed in the yellow pages of your phone book) or write for descriptive bulletin GEC-1305, Section 712-3E, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC



FASTEST CUTTING DISC-WHEEL PROVES ITS ECONOMY ON BIG JOB

Substantial savings in grinding time and costs were realized by using Bay State's Blue Flash raised hub disc-wheels selected by competitive testing for this 17-Ton, all-welded broach base. The tests were run because production time and costs were critical factors in the engineers' decision to substitute weldments for castings.

Only 10 working days were allowed for production of the 18′ x 5′ fabrication designed to withstand 100 Tons of broaching pressure. The flame-cut sections of type 1020 hot rolled steel used varied in thickness from ½″ to 3″. Multiple passes of high quality E6020 weld metal were deposited in the deep butt joints. This was carried into a final reinforcing layer, and finished in smooth contours by the grinding.

Finish was important on these long, heavy welds, since the structure was to be shipped sand-blasted and prime coated, ready for painting.

The specification of the successful wheels was Blue Flash A-24R-BF, as reported in Industry & Welding in the quotation shown on the next page. Available in a range of characteristics covering all weld grinding applications, Blue Flash's tremendous rate of stock removal comes from its special "open" construction and high grain concentration.

(Advertisement)

GENERAL ELECTRIC

Instant Cutting Upon Contact, and over the entire under-surface of the wheel, make Blue Flash the fastest, most economical disc-wheel for all weld grinding. Only light pressure is needed, and corner welds grind down quickly and easily because of the large contact area.

Grinding corner weld on huge weldment at Framingham Welding and Engineering Corp., Framingham, Mass., as reported in Industry & Welding.

"Because of a greatly accelerated production schedule and the importance of grinding from an appearance standpoint, it was decided to test a wide variety of wheels before selecting one" . . . for grinding welds on the giant broach base shown.

"As a result of this extensive testing, a new reinforced disc-wheel made by Bay State Abrasive Products Co., the BF— Blue Flash (Specifications A-24R-BF), was adopted. It proved to be extremely fast cutting."

Test Blue Flash on your weld grinding. It's always available from your BAY STATE DISTRIBUTOR.

BAY STATE ABRASIVE PRODUCTS CO., Westboro, Mass., U.S.A.

Branch Offices and Warehouses — Bristol, Conn.; Chicago, Ill.; Cleveland, Ohio; Detroit, Mich.; Pittsburgh, Pa.

BAY STATE WHEELS of PROGRESS

Distributors — All principal cities
In Canada: Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ont.

Circle No. 29 on Reader Service Card.

NEWS of the WELDING INDUSTRY

Wins Achievement Award

Ray Townsend, Tweco Products, Inc., accepts the Santa Clara Valley Achievement Award for "outstanding contributions and leadership in the field of welding", on both national and local level. Making the presentation at the annual meeting of the Santa Clara Valley Section of the A.W.S., is Wallace J. Erichsen, Westinghouse Electric Corp., outgoing Chairman of the Section. National Membership Chairman of the American Welding Society in 1954-1955, Mr. Townsend also spark-plugged the successful first Santa Clara Valley Welding Show and Clinic held in Los Gatos, Cal., in April, serving as Show Committee Chairman.

New Quarters for York

York Engineering Company, Chicago manufacturer brazing and welding fluxes and anti-spatter compounds, has announced occupation of their new, modern, large office and factory building at 2711 South Kedzie Avenue, in Chicago.

The new facilities were planned to take care not only of present requirements, but would also allow for expansion in years to come, according to Irving Silver, Vice-President of the company.

Drawalloy Names Marshall Field Engineering Manager

E. J. Brady, president, Drawalloy Corporation, recently announced the appointment of Bond Marshall to the position of Manager of Field Engineering. Mr. Marshall will specialize in the application and development of automatic and semi - automatic hard facing wires in conjunction with the company's newly announced line of fabricated hard facing wires.

Marshall is a graduate of Carnegie Institute of Technology with a B. S. in Metallurgical Engineering.

(More News on Page 40)

Welded with ATOM·ARC 7016

High up in the steelwork where it's windy and exposed, welding can be a problem. But weldors are enthusiastic about Atom • Arc, not only for its speed but for its ease of operation in all positions and its materially reduced spatter.

Dominion Bridge Company of Canada is using Atom • Arc 7016 iron powder, low hydrogen electrodes* in welding the steelwork for this 21-story hotel. It's Canadian National Railway's new 20-million dollar Queen Elizabeth Hotel in Montreal.

Joining the lighter beams to the heavy columns without preheating called for low hydrogen electrodes. Atom • Arc 7016 electrodes in 5/32" diameters were adopted with the approval of both the weldors and Canadian National's inspectors. Along with the essential advantages of highest physical properties, x-ray quality weld metal and freedom from underbead cracking, Atom • Arc electrodes have a deposition rate much greater than standard 6010 electrodes. Starting porosity is eliminated and moisture pick-up is reduced.

Atom • Arc iron powder, low hydrogen electrodes have become standard on many structural and fabricated equipment welding operations. Find out why Atom • Arc is the first choice of users—write today for complete information. Alloy Rods Company, York 1, Pennsylvania.

Alloy Rods Co.

General Offices and Plant
Lincoln Highway West
YORK 1, PENNSYLVANIA

Pacific Coast Sales
Office and Plant
750 Lairport Street
EL SEGUNDO, CALIF.

no finer electrodes made... anywhere

ATOM • ARC is sold in Canada by Canadian LIQUID AIR Company, Ltd.

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Coming Welding Events

NWSA Zone Meetings
- Sept. 20-21, Hotel Statler, New York City
- Sept. 24-25, Hotel LaSalle, Chicago, Ill.

AWS National Meetings
1956 Fall Meeting:
- Oct. 8-12, Hotel Cleveland, Cleveland, Ohio

1957 Spring Meeting and Welding Show, Apr. 8-12, Hotel Sheraton, Philadelphia, Pa.

National Metals Exposition:
- Oct. 8-12, Thirty-eighth National Metal Exposition and Congress, Cleveland Public Auditorium, Cleveland, Ohio

Eutectic Names Production Manager

Appointment of Harley Erickson as Production Manager for Eutectic Welding Alloys Corp. has been announced by Rene D. Wasserman, president. Formerly with Lincoln Electric and General Electric, Mr Erickson will work with Joseph P Quaas, director of manufacturing and production.

G.E. Cleveland Branch Holds Open House

More than 200 persons were guests at a recent open house which marked the opening of the Cleveland Direct Sales Branch of General Electric's Welding Department. Guests say demonstrations and displays of welding machines, electrodes and accessories. Buffet was served and door prizes awarded. Herb Hinkel is in charge.

(More News on Page 124)

I.W.D.A. Officers Elected. At the annual meeting of the Independent Welding Distributors Association held recently at San Diego, California, this sun-bathed group elected the following officers for 1956-57: O. H. Koll, Welders Supply Service, Modesto, Cal., President, and W. V. Raymond, California Welding Supply Co., Stockton, Cal., Vice-President.

you know,
this **miller** *AEA-200-L*
is quite a deal

The man's right of course, and here's why: As a welder, it provides a full 200 amperes of ac welding current . . . handles ac or ac-dc electrodes up to 3/16". As a power plant, the rotating field design generator—coupled to Onan CK engine—supplies 4500 watts of 110/220 current; or, 1000 watts of dc power while welding. Waterproof and light weight (435 lbs.), the AEA-200-L offers easy portability, all-weather operation and real versatility. Rubber-tired running gear and road trailer available. Model AEA-200, without auxiliary power, weighs 420 lbs. Larger engine driven units to 350 amperes with generator output of 10KW.

"...if it's Miller you know it's the finest..."

New MILLER ARCWELD welding electrodes are worthy of the MILLER name and reputation. Ask your distributor for some . . . you'll like the job they do.

miller
ELECTRIC MANUFACTURING CO., INC.
APPLETON, WISCONSIN
Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal, P.Q.

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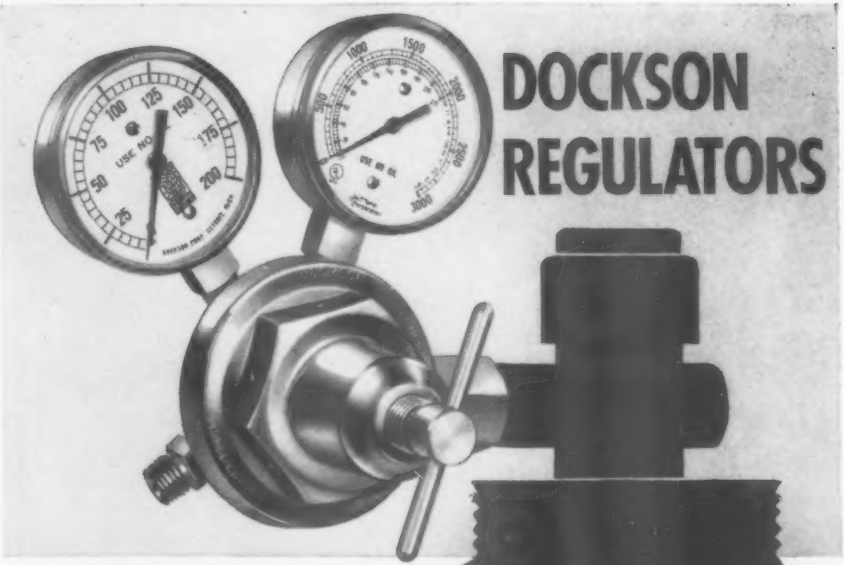
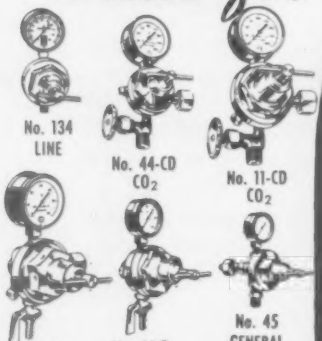


DOCKSON REGULATORS

Built for Better Service!



STURDY CONSTRUCTION—Forged brass bodies, shatterproof gauges, dependable safety valves.

LOW COST—Replaceable, self-aligning seats; minimum of moving parts.

GUARANTEED—Against defects in materials or workmanship for one year in regulator proper.

YOUR DOCKSON DISTRIBUTOR—Is a carefully selected specialist who carries a complete line of Dockson products in stock to give you fast service and personal attention. We back our distributors 100%.

WRITE FOR YOUR DISTRIBUTOR'S NAME AND OUR COMPLETE CATALOG OF WELDING AND CUTTING EQUIPMENT.

Dockson
CORPORATION
3839 WABASH • DETROIT 8, MICH.

Circle No. 32 on Reader Service Card.

STAINLESS STEEL WELDING WIRE...

Spooled . . . layer wound to assure a smooth, even feed. Sizes: .035", .045", 1/16", 5/64" and 3/32" diameters.

Coiled . . . layer wound on rims for submerged arc welding. Sizes: 1/16", 5/64", 3/32", 1/8", 5/32", 3/16" and 1/4" diameters.

Cut Lengths . . . straightened and cut wire furnished in 36" lengths for inert arc and gas welding. Sizes: .035", .045", 1/16", 5/64", 3/32", 1/8", 5/32", 3/16" and 1/4" diameters.

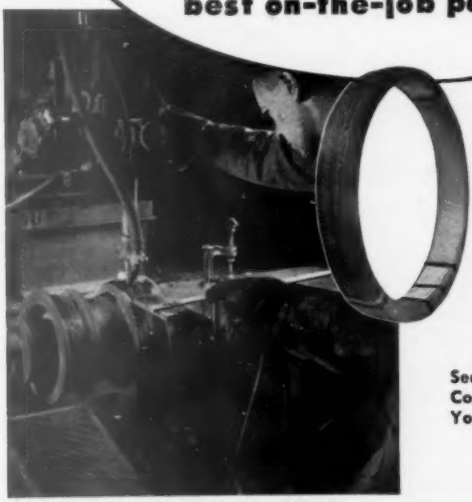
Two factors give

Drawalloy

CORPORATION

WELDING WIRE

best on-the-job performance



Drawalloy welding wire is a product of two factors—years of experience in the welding industry combined with the best wire mill drawing practices. The result is clean welding wire with the proper finish, temper, diameter tolerance and chemical analysis. It's a wire that produces the highest quality welds continuously—with an easy, sure feed and a constant, smooth arc.

See your distributor or write Drawalloy Corporation, Lincoln Highway at Alloy St., York 11, Pennsylvania

WEAR-O-MATIC HARD-FACING WIRE...

Coiled . . . precision drawn for perfect roundness to insure continuous, smooth feed with any automatic head. Available in six Types for hard-facing applications.

Drawalloy
CORPORATION
The Wire Mill For The Welding Industry
YORK 11, PENNSYLVANIA

Circle No. 33 on Reader Service Card.

Literature Featured In Ads This Month

TO GET ANY OF THE REFERENCE DATA DESCRIBED HERE, CIRCLE THE APPROPRIATE NUMBER ON THE READER SERVICE CARDS IN THIS ISSUE

6 **High strength, high ductility electrodes** featured in 44 page booklet. AIR REDUCTION SALES COMPANY. Page 7.

8 **Choose special resistance welding electrodes from existing designs** shown in complete resistance welding catalog. P. R. MALLORY & CO., INC. Page 9.

9 **All answers to questions on regulators** are given in new 44-page book. NATIONAL WELDING EQUIPMENT CO. Page 10.

10 **Positioner load capacity table** available to help you select the model you need. HARNISCHFEGER CORP. Page 11.

11 **Resistance Welding electrodes** are covered in comprehensive catalog. TIPALOY INC. Page 12.

16 **Metallizing opportunities for the small shop** are described in bulletin. METALLIZING ENGINEERING CO., INC. Page 17.

17 **Semi-automatic welding equipment** for CO2 and inert-gas metal arc is illustrated and described in bulletin. NATIONAL CYLINDER GAS CO. Pages 18-19.

18 **Safety goggle comfort over prescription glasses** is engineered according to available literature. AMERICAN OPTICAL CO. Page 20.

19 **Powerized welding jobs** with positioners and turning rolls are featured in illustrated brochure. PANDJIRIS WELDMENT CO. Page 21.

20 **Solid copper welding circuit** from welding to electrode is the story in booklet form about holders, cable and connectors. ERICO PRODUCTS INC. Page 23.

22 **All-purpose face shield** for welding, grinding and heat protection is described in bulletin. FIBRE METAL PRODUCTS CO. Page 4.

26 **Two silver brazing reference manuals** give procedures and money saving tips on all types of applications. THE AMERICAN PLATINUM WORKS. Page 3.

29 **Fast cutting disc-wheels,** and how they can save grinding time and costs is subject of bulletin containing technical and operating data. BAY STATE ABRASIVE PRODUCTS CO. Page 37.

32 **Complete line of regulators** are featured in a catalog of welding and cutting equipment. DOCKSON CORPORATION. Page 42.

33 **Stainless steel welding wire,** spooled, coiled or in out lengths. is subject of illustrated catalog. DRAW-ALLOY CORPORATION. Page 43.

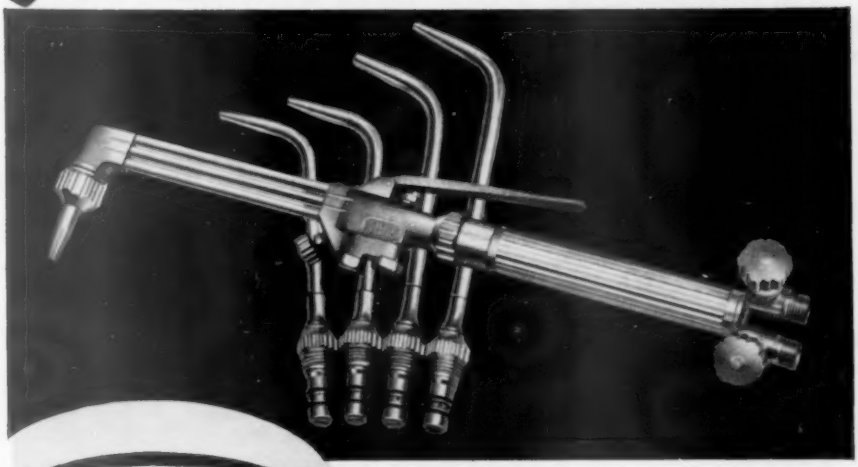
41 **Iron powder, low hydrogen electrodes** for quality welds on structural and fabricated equipment operations is completely described in bulletin. ALLOY RODS COMPANY. Page 39.

48 **Aluminum welds that can take it.** Colorful booklet tells how to get them. ALUMINUM COMPANY OF AMERICA. Pages 78-79.

50 **The right welding wires in the right package.** Two booklets tell about submerged arc and inert gas welding wire and gas welding rod. PAGE STEEL & WIRE DIV., AMERICAN CHAIN & CABLE CO. 58-59.

53 **How to replace burned off galvanizing** to regain corrosion resistance is explained in bulletin. METALLOY PRODUCTS CO. Page 88.

Light, handy Torch does multiple jobs... *cuts, welds, heats, brazes, solders*



SMITH'S

"PIPELINER" Welding Torch and Cutting Assembly

...*with slip-in tips*

Developed originally for pipeline welders, this popular little guy has been drafted for all kinds of other uses. You can do welding from 1/32" to 1/4", and brazing and heating jobs. Eight other sizes of Soft-Flame tips increase welding capacity to 7/8". With the cutting assembly you can burn steel from 1/8" to 4" in thickness —clean, high speed cuts with minimum gas consumption. Insert special tips and you can do heavy scarfing, rivet washing and gouging. Tips slip in, tighten with finger twist (no wrench needed). Operators really like that handy 2 lb. weight! Over-all length 16". Your choice 90° or 75° head angle.

Full information on request — mail coupon

SMITH WELDING EQUIPMENT CORP.

DEPT. IW-192 • 2633 S.E. 4th Street • Minneapolis, Minn.

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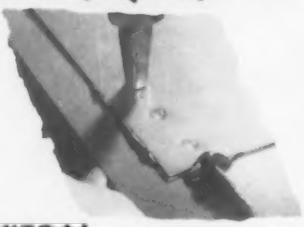
WATER-TIGHT ... CORROSION-FREE SEAMS with

PARWELD SPOTWELD SEALER



EXTRA!

- Weld button blow-back eliminated.
- High-speed gun application.
- Low resistance that saves current and time.
- Electrodes may be used in contact with sealer without freezing or pitting.

Try a sample at our expense!

THE PARR PAINT & COLOR CO.

18312 Syracuse Ave., Cleveland 10, Ohio

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60 **Easy-to-use stainless electrodes.** Two types—one for sheet metal, another for heavy stainless are explained in illustrated booklet. ARCOS CORPORATION. Page 98.

66 **Heavy duty sander-grinder** for weld finishing is completely described in folder. MILWAUKEE ELECTRIC TOOL CORP. Page 105.

68 **Wear plate steel** welded-on where needed most. Applications are explained in informative bulletin. ALLIED STEEL & TRACTOR PRODUCTS, INC. Page 106.

72 **Big job, high production spot** welders are featured in a tells-all brochure. FEDERAL MACHINE & WELDER CO. Page 110.

75 **One machine bends many forms** according to bulletin now available. HOSSFELD MFG. CO. Page 112.

76 **Wipe that spatter off your job, and come clean!** Bulletin tells how with new bulletin. YORK ENGINEERING CO. Page 113.

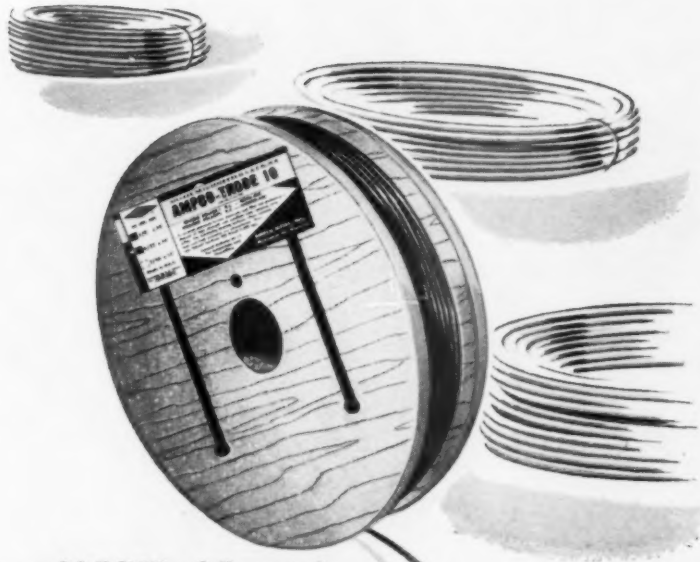
73 **Instant check on welding current** with Tong test ammeter. Bulletin explains how raise quality and lower costs. COLUMBIA ELECTRIC MFG. CO. Page 113.

77 **AC-DC Welder** for all types of electrodes and welding jobs is featured in booklet, yours for clipping a coupon. LINCOLN ELECTRIC CO. Page 117.

79 **Chipping hammers** best suited to your weld cleaning requirements are featured in circular showing the complete line. CHICAGO MFG. & DISTRIBUTING CO. Page 119.

85 **Power operated positioners** are the subject of a new catalog explaining how to get more arc time—lower costs. CULLEN-FRIESTEDT CO. Page 123.

88 **Magnetic adjustable links** speed welding jobs. How, explained in illustrated folder. JAMES NEILL CO. Page 125.



If you weld "difficult" metals with MIG consumable electrodes

you can do a faster, better job with

AMPCO-TRODE* 10

BARE WIRE

Here's versatile welding at its best. Ampco-Trode 10 Bare Wire, level-wound on spools or rims for the metal-arc, inert-gas process, gives you easy, high-strength, crack-free welds on aluminum bronze, silicon bronze, and manganese bronze. You also get clean, dense deposits on iron-base metals — cast and malleable iron, galvanized iron, and high alloy steels and irons. You can even make good welds joining one of these metals to another. And Ampco-Trode 10 Bare Wire is also ideal for wear- and corrosion-resistant overlays with hardnesses of 160-190 BHN.

You get more. Ampco-Trode 10 *pre-alloyed, solid wire* feeds better through the gun with fewer burn-backs. And the deposit is more uniform, giving you mechanical properties that are superior to "so-called" substitutes. That's why this versatile electrode can make a better product for you — at less cost. See your Ampco Weldrod Distributor.

Write for Bulletin W-17

AMPCO ®

Sole producer of genuine Ampco Metal

AMPCO METAL, INC.

Dept. IW-9, Milwaukee 46, Wisconsin

West Coast Plant • Burbank, California

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Tough! as they come

The modern Atlas plant is devoted exclusively to building the finest weld cleaning tools in America. There are models to suit the man and every type work. If you haven't tried Atlas you don't know what a difference "balance and feel" can make in production and quality of work. They can take it.

ATLAS WELDING ACCESSORIES INC.

707 E. LEWISTON AVENUE FERNDALE 20 (DETROIT) MICH

B-1 "Re-Bit" Dual Tool 10½" 16 oz.

B1-W "Re-Bit" Dual Tool 10½" 15 oz.

Model A Dual Tool 10½" 17 oz.

Model AW Dual Tool 10½" 16 oz.

Model E-1 "Re-Bit" 9" 12 oz.

Model E1-W "Re-Bit" 9" 10 oz.

Model F-1 "Re-Bit" 10" 16 oz.

Model F1W "Re-Bit" 10" 14 oz.

Model G Chisel & X-Chisel 9" 14 oz.

H-9" 14 oz. L-10" 17 oz. Cone & Chisel

Model I Chisel & X-Chisel 9" 13 oz.

J-9" 13 oz. N-10" 15 oz. Cone & Chisel

LCP-10" 17 oz. HCP-9" 14 oz. Cone & X-Chisel

Model K Cone & X-Chisel 10" 17 oz.

JCP-9" 13 oz. NCP-10" 15 oz. Cone & X-Chisel

Model M Chisel & X-Chisel 10" 15 oz.

Models WH: 10-20-30 12" 14 oz.

Model C "Re-Bit" Chisel & symbol

Model CW "Re-Bit" Chisel & symbol

Models OCC—OCP—ODC 9½" 10 oz.

ASK YOUR DEALER TO SHOW YOU THE ATLAS LINE

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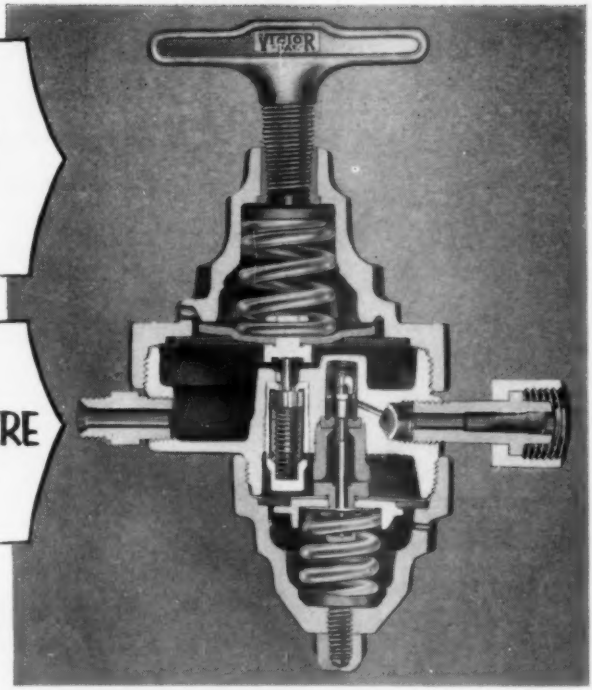
The man on the job prefers **VICTOR** Safety Regulators

THIS INSIDE PICTURE TELLS WHY



Cut-away of Model VTS400 series 2-stage Safety Regulator. Victor makes regulators for almost every gas and use, for pressures to 10,000 p.s.i., and volumes to 28,000 c.f.h.

You Get Greater Safety. All Victor regulators have "stem type" seat mechanism that closes with impact of inlet pressure, thus protects against seat ignition because the incoming gas loses its heat of compression by expanding into the inlet pressure chamber before passing over the seat and through the nozzle. High inlet pressure type regulators have reliable, self-reseating relief valve. Diaphragms protected from excessive, damaging movements by "stops" and rubber cushions. Porous sintered bronze inlet filter keeps out dirt, foreign material.

Single and Two-stage Types. Victor offers single-stage regulators to meet most capacity or delivery pressure requirements; and two-stage regulators for operations requiring a constant delivery pressure over a range of varying inlet pressures.

Standardize on Victor Safety Regulators, as so many other nationally-known companies do. Call your Victor dealer NOW.

VICTOR for welding

VICTOR EQUIPMENT COMPANY

Mfrs. of welding & cutting equipment; hardfacing rods, blasting nozzles; cobalt & tungsten castings; straightline and shape cutting machines. 34

844 Folsom St.
San Francisco 7

3821 Santa Fe Avenue
Los Angeles 58

Circle No. 38 on Reader Service Card.

Switching from manual arc welding to automatic submerged arc cut welding time in half and produced smooth, uniform welds.

Automatic submerged arc welding of this assembly is a push-button operation resulting in smooth, uniform welds which require little or no preparation for painting.

SUBMERGED ARC PROCESS ENDS STOP AND GO WELDING

by R. S. HARRIS, Supt.
Littleford, Bros., Inc.

Special fixture holds assembly as operator makes first 50-inch long seam weld (left). Rotating the fixture slightly locates second seam for welding (right).

A SWITCH to automatic submerged arc welding is producing smoother and more uniform welds in units fabricated by Littleford Bros., Inc., Cincinnati, Ohio. The change was made because Littleford's customers demanded smooth, easy-to-paint surfaces. Manual arc welding was discarded because stopping and restarting left rough marks which were difficult to paint without extensive finishing operations.

Cut Welding Time In Half

In addition, the change cut welding time exactly in half. Submerged arc welding now makes two 50-inch welds in four minutes. Previously, manual welding with contact-type electrodes had required eight minutes.

Units are 50-inches long and are made of a semi-circular 11-gauge steel body whose two ends are welded to a $\frac{5}{8}$-inch thick base plate.

In the past, $\frac{5}{32}$-inch diameter electrodes were used at 225 amps DC. Stopping to replace electrodes and restarting was done less often with contact-type electrodes than with conventional types, but was still too much as far as the customer was concerned.

Here's how Littleford did it.

Using $\frac{1}{8}$-inch diameter copper-coated wire and 390 amps DC at 30 volts, one-quarter inch fillet welds are made in a single pass at speeds of about 39 ipm. Power is furnished by two 500 amp DC welders connected in series.

No edge preparation is required. The 11-gauge body is merely butted against the $\frac{5}{8}$-inch plate and tacked with $\frac{1}{2}$-inch welds made on 6-inch centers.

End tabs are welded on and assembly is positioned in a special fixture. After a flux holding device is placed around weld area, operator positions equipment, presses button on control panel and welding starts. After first weld is made, fixture is rotated slightly and other weld is made.

Finished welds have good penetration and are smooth, uniform in appearance.

Oxy-acetylene flame cutting performs a variety of jobs in the Southern Pacific shops. Cutting sheet metal and plates to desired size for repairs and fabrication (top) is a job for the light-weight, motor-driven gas cutting machine. More complex cut-outs, such as sprocket sections, are flame cut using a portable precision shape cutting machine.

How the Oxy-Acetylene Flame Helps

By T. S. BEAN, Superintendent System Maintenance of Way Shop Southern Pacific Co., Oakland, Cal.

THE oxy-acetylene flame has become as much an accepted tool in the maintenance-of-way department of our railroad as any machine tool yet devised. It repairs, rebuilds and reworks worn, broken and damaged equipment and track, in the shops and in the field.

The Southern Pacific Railroad has numerous items of work equipment which are maintained in Maintenance of Way Shops. Our large System Maintenance Shop located in Oakland, California, is equipped to handle the major heavy repairs to the equipment. It is here that greatest use is made of the oxy-acetylene flame.

Structural steel plates used in repairs and fabrication are cut to

Torch brazing used to repair broken casting (above) and get it back into service in a hurry. Flame hardening operation (below) doubles the life of rails.

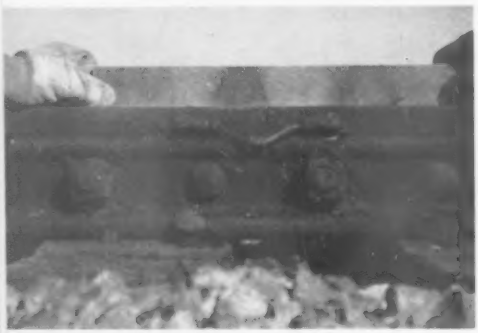
Metallizing uses oxy-acetylene flame to build up worn crankshaft with wear-resistant metal (above) and for sealing cracks in an engine block (below).

Southern Pacific "Run a Railroad"

size by means of light weight motor-driven oxy-acetylene cutting machines, which provide linear motion by means of electric motor drives having controlled speeds. These machines cut vertical straight lines, bevels, arcs and circles.

For more complex contour cutting of materials, we use a portable shapecutting oxy-acetylene machine. The work is so accurate that in many instances no machining is necessary.

Due to many varieties of equipment we maintain, obtaining of replacement parts presents problems. To expedite repairs and to effect savings parts are usually reclaimed. One method is metallizing with an oxy-acetylene metal spray gun. Items such as shafts, pistons and other parts having worn bearing areas are reclaimed by this process. In the build up of these surfaces we use a spray wire



Chrome vanadium hard facing alloy is applied to battered rail ends by oxy-acetylene torch. Rail condition before being hardfaced (top). Operator puddles-on wear resistant chrome vanadium alloy (middle). Completed rail-ends (bottom) will outlast a new rail.

of high chrome, high carbon stainless steel which, when ground, extends the wear life from two to five times that of the original metal.

Metal Spraying Seals Cracks

Metal spraying is also used to repair cracks in water jackets of engine blocks and cylinder heads with considerable success. The repaired engines are water tight and show no porosity.

Considerable savings will result using this method to seal cracks as they can be welded in position with little preparation. Too often cracked blocks must be stripped to be brazed and the expense of pre-heating and remachining is prohibitive. This is particularly true of assembled motors in otherwise good condition that develop cracks in the outside water-jacketing of cylinder heads or cylinder blocks.

Cold welding processes and drilling and tapping of the cracks to insert overlapping studs have been used with some degree of success; too often these do not form a perfect waterseal.

Braze Broken Castings

Many broken castings are reclaimed by brazing. Small castings are usually pre-heated with the torch; larger castings require specially built ovens for heat control. The latter are pre-heated by gas torches and the heat is controlled during the welding and post-heating by briquets. We have successfully welded machinery deck castings weighing upwards of 5 tons in this manner.

All shop crafts now rely on the acetylene torch to perform their work. We have numerous two-wheel tank-mounted hand trucks complete with regulators, hoses and torches for their welding, cutting and heating. The portability

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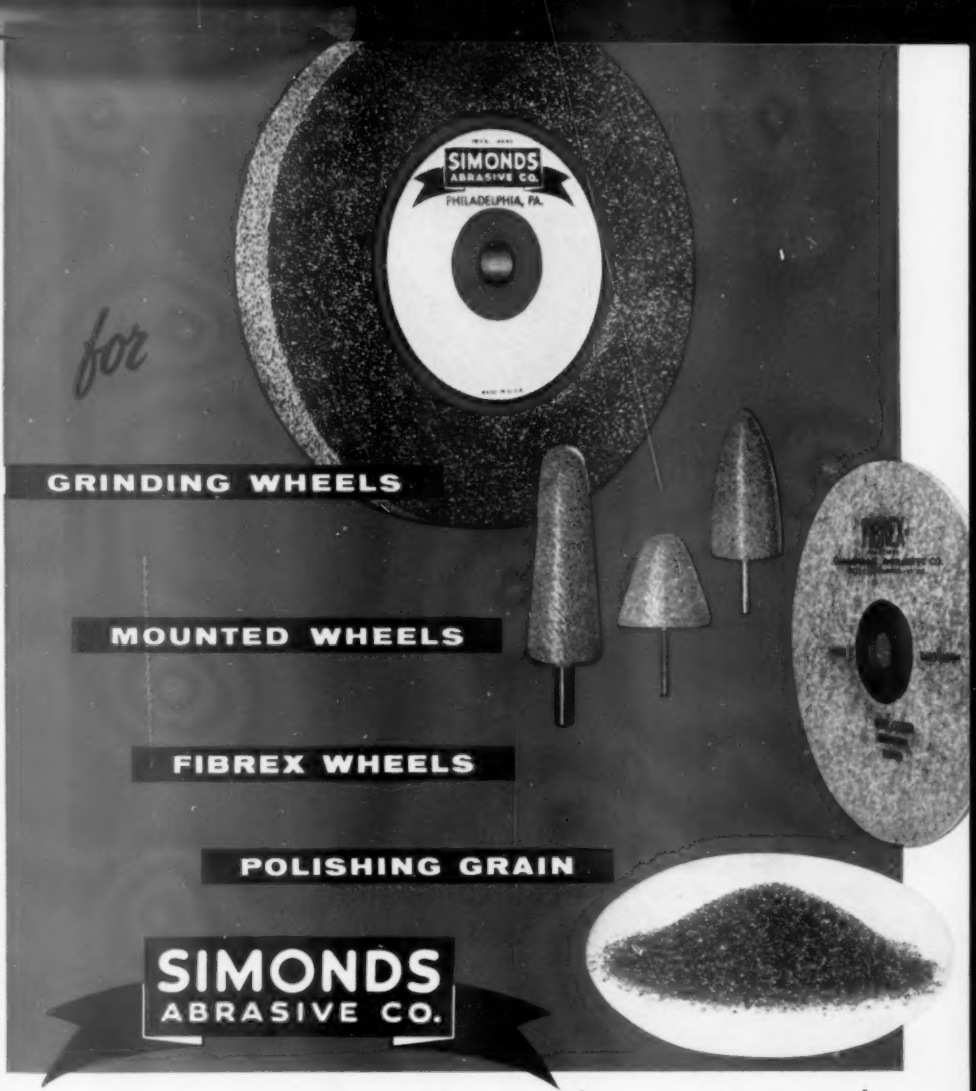
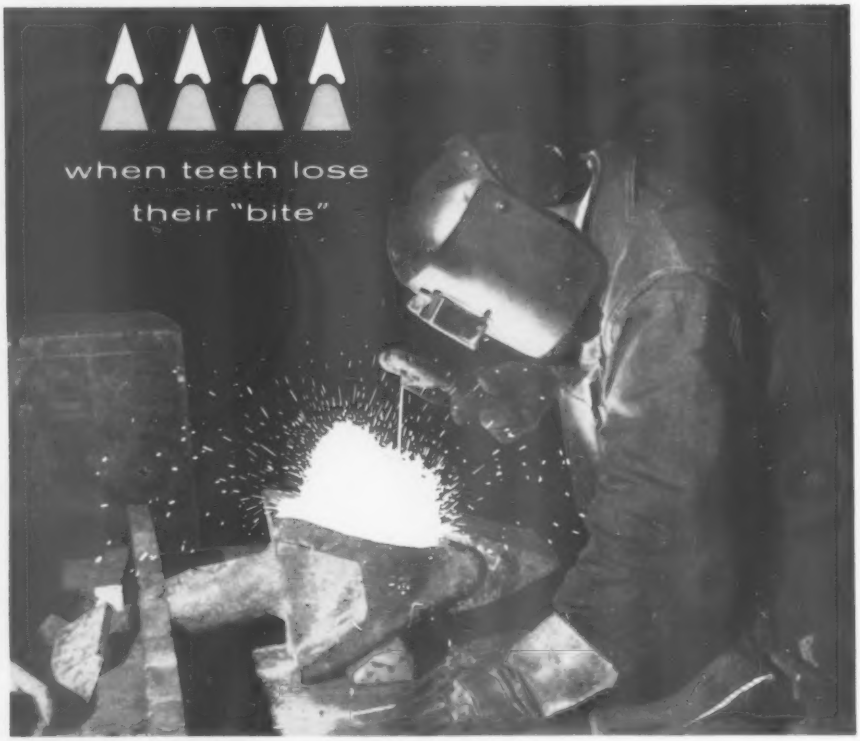


at your service for efficient grinding

For the results you want, plus the economy you need, use Simonds wheels for long, continuous service on maintenance and precision grinding — Fibrex wheels for fast, safe action on metal finishing, weld grinding, cutting-off, cleaning up — and Borolon grain for real savings on all your polishing jobs. Order from your Simonds Abrasive Company distributor.

SIMONDS ABRASIVE COMPANY • PHILADELPHIA 37, PA.

Branch Warehouses: Boston, Detroit, Chicago, Portland, San Francisco
Division of Simonds Saw and Steel Co., Fitchburg, Mass.



It's a **15-MINUTE REBUILDING JOB**
with Amsco® Cast-to-Shape Repointers

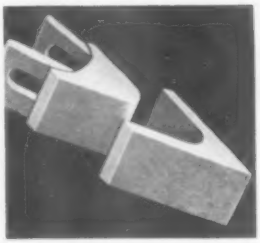
Easy to weld on . . . add strength and service life to entire tooth

Where dipper-tooth wear is moderate, and where digging conditions are not too severe, Amsco Cast-to-Shape Repointers provide a cost-saving answer to tooth replacement.

An average-size tooth can be completely rebuilt in about 15 minutes. The repointer overlaps the tooth top and bottom and is easily welded in place, using only a few electrodes.

Cast of Amsco Manganese Steel, with "ears" that protect the flat sides of the tooth, these repointers add strength and service life to the entire tooth. Available as individual repointer units, or in bar lengths.

For heavy digging, use Amsco "Wear-Sharp" Repointers or Repointer Bars. Order Amsco Repointers from your nearby Amsco Distributor.



AMERICAN Brake Shoe COMPANY

AMSCO

American Manganese Steel Division · Chicago Heights, Ill.

OTHER PLANTS IN: DENVER, LOS ANGELES, NEW CASTLE, DEL., OAKLAND, CAL., ST. LOUIS, JOLIETTE, QUEBEC

Distributed in Canada by Canadian Liquid Air Co., Ltd.

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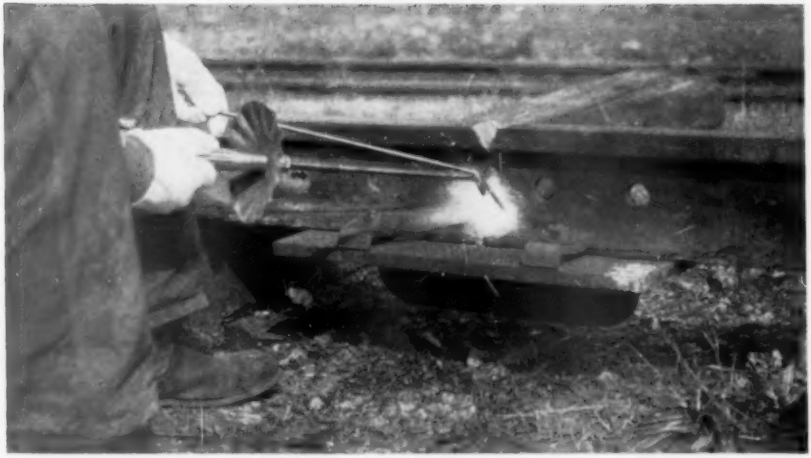


Rails are butt welded with oxy-acetylene torch when hard surfacing alloy is to be applied in areas of extreme wear. Operator welds the joint with chrome vanadium filler rod.

of these units is an advantage to us for we are not restricted to in-shop use. Much of our work is done in outside storage areas and loading areas.

The machinist uses the torch for general cutting and for building up procedures. Many slide wear plates are reclaimed by rebuilding with bronze. So are pistons from oil and water duplex pumps used throughout the railroad. Some of these pistons are as great as 18-inches in diameter.

We are now using the oxy-acetylene torch to flame-harden the stock rails of switches to increase their service life. These rails are renewed frequently because of excessive wear on the short section in the area of the switch point. Field tests have shown that flame-hardening doubled their life.

As a result, flame-hardening of stock rails is now a continuous process. A fully equipped track shop in Sacramento performs all operations of this work including the machining, flame-hardening, and the bending of the rails as well as other types of rail work.

We rebuild a large per cent of battered rail joints with the oxy-acetylene process. The ends of rail at the joint take a continuous pounding from the concentrated loads on car wheels under traffic. It is estimated on our Pacific Lines 65000 joints were welded in this manner last year, and 1,980,000 cu. ft. of acetylene and oxygen were consumed in the process.

The oxy-acetylene torch is also used to butt weld rails in all road crossings, streets, and station platforms where the area is to be hard-surfaced to the track level. The rails are butt welded before being placed into the track.

Based on a paper presented before the 1956 Convention of the International Acetylene Association.

PAGE offers a line of —the right packaging—the

In ever-increasing numbers, users of welding wire are looking to PAGE for their wire needs. The one biggest reason is that they have found that PAGE—in a unique degree—has the *facilities, experience* and *special skills* to draw and furnish exactly the right wire for your welding jobs. And behind that lies a story.

All Processes Closely Controlled

PAGE is *the one supplier* of welding wire who is in a perfect position to control the chemical and physical properties of its products all the way from billet to rod to finished wire. That is because we purchase our raw materials to rigid specifications; we select heats of carbon, low alloy and stainless steels for certain optimum characteristics—then, upon delivery to the mill, we analyze representative samples for compliance with PAGE specifications.

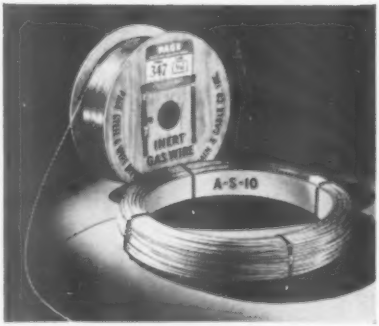
These purchasing and testing practices permit the production of wire capable of depositing weld metal which complies absolutely with welding requirements. *You don't have to compromise* when you buy, specify or use welding wire by PAGE!

Page Meets Today's Needs

One example of PAGE's facilities for furnishing a wide range of quality-controlled welding wires for modern applications is shown by our stainless steel automatic welding wire. To meet needs of recent developments in the field of inert gas welding, PAGE offers fine wires (.020" to .09375") for use in semi-automatic arc welding machines in which the arc is shielded with argon, helium or CO_2 inert gas. These wires, wound on non-returnable plywood reels, furnish the utmost in convenience and freedom of wire feed.

Wire for All Types of Welding

You will find many advantages in standardizing on PAGE welding wire for your needs—whether for automatic or manual use . . . arc or gas welding of all types. Not only does PAGE offer a wide range of analyses, as shown in the column at the right, but we have unsurpassed facilities for manufacturing wire to any desired size, temper or surface finish—and can furnish it promptly, in many methods of packaging, through the convenient nation-wide PAGE Distributor service.



The Right Wire— Wide Analysis Range

There are *26 different analyses* in the PAGE line. These cover the field of applications: heavy automatic submerged arc...light manual submerged . . . inert gas manual . . . automatic, tungsten or metal arc.

AUTOMATIC WELDING WIRE

CARBON STEEL...Any carbon from Armco (.025 max.) to high carbon (.90-1.10)
LOW ALLOYS...All the most popular welding grades.
STAINLESS...All standard AISI grades. Other types on request.

GAS WELDING RODS

Since 1914, the standard of quality, uniformity and satisfactory performance. PAGE offers an exceptionally wide range of rods—furnished in 36-inch lengths, in coils or on reels in the following materials: Mild Steel • Armco • Low Alloy • Carbon Steel • Stainless Steel • Manganese Bronze • Naval Bronze

BARE ELECTRODES

PAGE Bare Electrodes are supplied in any carbon from Armco to high (.90-1.10) carbon.

METAL SPRAY WIRE

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the right welding wires
right service—for modern needs

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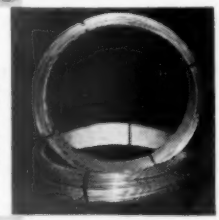
PAGE Welding Wires are packaged in a wide variety of ways for the most complete protection and the utmost convenience in handling, in stocking and in use.

Wrapped Coils and Coils in Cartons

Single and palletized coils, each coil steel-strapped and wrapped in waterproofed paper. ...Also, coils in individual cartons, singly or palletized.

Welding Wire in Coils

PAGE A-S Automatic Welding Wire is regularly furnished in layer wound coils with cardboard liner, four Signode straps to facilitate coiling and easy unwinding.

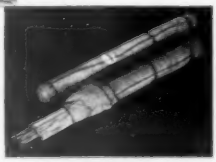


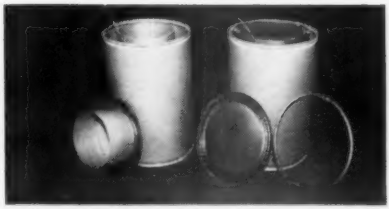
Handy Reels

PAGE Inert Gas Welding Wire is available on reels: Precision thread-wound on twenty-five-pound, non-returnable reels to fit all popular inert gas welding machines.

Gas Rod Packing

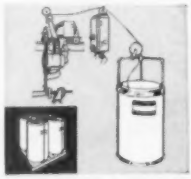
Gas welding rods are packed in 36" lengths in 50-lb. bundles—paper and burlap wrapped. Also in coils and reels (approx. 150 lbs.)—burlap wrapped. Stainless rods also come in 10-lb. fibreboard cartons.





LEFT: Pay-off-pak ready for filling, with "wire slinger" for uncoiling at extreme left. RIGHT: "Wire slinger" installed for feeding out wire; also, below, re-usable lid and retaining ring. Ring insures smooth feed-out of wire without snarls or kinks.

Sketch at right shows Pay-off-pak for continuous feeding up to 500 lbs. of wire without rethreading. Also (inset) lightweight Leverpaks. Both these containers protect against coil distortion... are easily opened, resealed, handled, stored.



PAGE Service Means Prompt Delivery From Local Stocks

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PAGE Distributors carry ample stocks from which your requirements can be filled without delay or inconvenience to you. This handy service not only saves you time in getting what you need, but makes it unnecessary for you to make a sizeable investment in inventory.

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"POSITIONEERING"

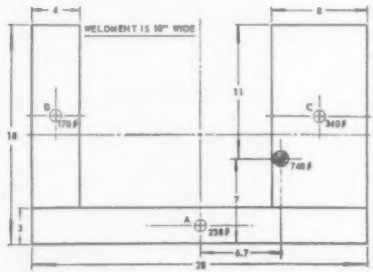
PART IV

MOUNTING THE WELDMENT:

Fixturing and Welding

by **CHARLES N. ARONSON**, President, Aronson Machine Co., Arcade, N. Y.

THIS weldment has a total weight of 748 pounds. To select a positioner simply on this known



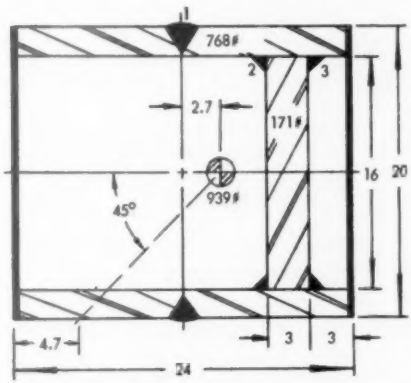
weight is apt to cause trouble. Let's say there is available a good, low cost positioner rated at 1,000 lbs. with center of gravity (CG) 12-inches above table top. The 1000 lbs. rating is 33 percent more than the 748 lb. load, a comfortable margin. But, consider where that 748 lbs. is concentrated. The CG is 5-inches from front or back, 7-inches from bottom, 11-inches from top, 7.3-inches from right side and 20.7-inches from left.

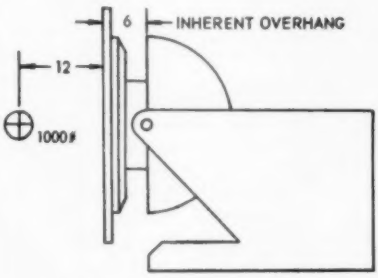
One thousand lbs. times 12-inches gives us a Load Torque Rating of 12,000 Pound-Inch (Lb.-In. or #") for the positioner considered. Mounting the weldment flat puts the CG 5-inches from table top, and 748 lbs. times 5-inches is 3,740 #" Load Torque, well within the rating. Mounted bottom to table it

is 748 lbs. times 7-inches or 5,236#"; right side to table 748 lbs. times 7.3-inches or 5,460#", top to table 748 lbs. times 11-inches or 8,228#". So far, all are well within rating. But, when we mount this weldment left side to table we have 748 lbs. times 20.7-inches equalling 15,484#", which is 3,484 lbs. over rated Load Capacity Torque, a 29 percent overload.

Thus, with this one weldment it is possible to mount it and use only 31 percent of the positioner's capacity or mount it another way and use 129 percent. When the CG is anywhere but on the geometric centerline point there is always the possibility of overload unless the positioner selected has a rating equal to the worst mounting conditions.

The case just considered was kept simple and did not take into account the distance the top of the table is from the true hinge point, the fulcrum. Now, let us take an example of a slightly irregular cylindrical weldment (below) and see what really does happen:





COMMON GEAR DRIVEN POSITIONER

L Load Torque Cap.= 18,000 Lb-In

Inherent overhang of common gear-driven positioners is a result of good design practice. There would be little to gain from the expense of making the table top flush with the Tilt Axis. Special jobs, like an orange peel weld on a hemisphere, might demand it, but that is extremely rare. If not expressly given, inherent overhang is the total of all dimensions between the trunnion hinge axis and the top of the table. Load Torque Capacity is rated load overhang (12-inches here) plus inherent overhang (6-inches here) times the rated load weight (1000 lbs. here).

The job here consists of two rings rolled 20-inches OD from 2-inch by 12-inch steel, welded to make a cylinder 24-inches long and then a 3-inch disc welded inside, 3-inches from one end. Let's say the reason the ring wasn't rolled from 2-inch by 24-inch steel is because available roll capacity would handle no more than the 2 by 12-inch. Welding will be submerged arc.

Fixturing is the first consideration. Any time spent setting-up is non-productive time. If parts can be welded without first tacking-up we can save that tacking time and in addition, avoid a tackweld being run over by the weld and perhaps causing flaws.

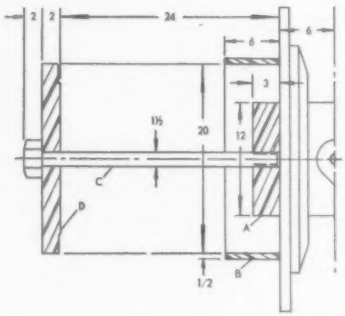
Positions required are determined by the welds. In this job Weld No. 1 will be made at 90°, Welds Nos. 2 and 3 at 45°. Loading is generally best done in the flat (0°).

The jigging (which means locating parts with respect to each other) is alignment of the two rings, and the 3-inches the disc must be from one end.

Limitations are that we must at the outside for weld No. 1 and the inside for Welds Nos. 2 and 3. The weld process is mechanical ("automatic"?) submerged arc, so we can't ask the operator to jump hold-down rods and such. Positioner contemplated will require the weldment to be flopped end-for-end once. (Note: A positioner made to avoid this one end-for-end flopping would cost a great deal, but would not be applicable to an othery job and would lose some of the advantages of the fixtures we have planned.)

The fixture should have a 3-inch high 12-inch diameter boss secured at the center of the table. This will provide the 3-inch jigging required. The center of the boss is tapped for a hold-down bolt long enough to allow tightening down on a crossbar across the outer end of the 24-inch cylinder we're making. This provides holding the two rolled rings securely against each other. A rap with a hammer will exactly align them.

The bolt and cross bar will be removed to allow placing the disc down inside and on the 3-inch thick boss. To hold weldment centered and to prevent it tipping out when tilted 45° for Weld No. 3, we have a 6-inch high ring with a 20-inch ID. This ring is 6-inches high so pull of gravity straight down from the CG in a 45° tilt falls inside the limits of the 6-inch ring. We have drawn that straight



Fixture Load Torque will be greatest when the bolt and crossbar are in place holding the two rolled rings for Weld No. 1. This Fixture Load Torque is the item most often neglected when figuring positioner loads.

Let's see how it does work out:

A is the center boss.
B is the 6-inch high ring.
C is the bolt.
D is the crossbar.

Inherent Overhang is 6-inches.
All parts are steel.

		Load Torque
A=12" OD x 3" thick=339.3 cu. in.....=96.0# @	7.5" CG Arm=	720#"
B=21" OD x 20" ID x 6" long= 193 cu. in.=55.0# @	9.0" CG Arm=	495#"
C=1½" Rd. x 25" long=44.2 cu. in.....=12.5# @	20.0" CG Arm=	250#"
D=2" x 3" x 20"=120 cu. in.....=34.0# @	25.0" CG Arm=	850#"
198.0#		2315#"

"Positioneering is the science of positioning a workpiece as a means of improving quality, increasing production and lowering manufacturing costs."

down line to make this clear. You see it crosses the surface of the weldment 4.7-inches from the end. The weight of the weldment will hold it in and will provide positive rotation because weldment is symmetrical and balanced about its longitudinal axis. That's all we need. (See page 62 for calculations).

This means that 2315#" of the positioner's Rated Load Torque will be used to move the fixture alone. (Note: For a little extra exercise, you can determine exactly where the CG of the total Fixture is by simply dividing 2315#" by the 198# weight, which comes out 11.6-inches. This Arm is measured from the Fulcrum, don't forget. So, the CG of the Fixture is located 11.6-inches minus 6-inches or 5.6-inches above the table top. The system we just went through is the way you can determine a CG location of any similarly symmetrical weldment.

Here's How Welding Is Done

Operation 1. Table is flat. Rings are placed with beveled edges together. Bolt and Crossbar are applied, snugged, top ring rapped in exact alignment with bottom ring and bolt tightened tight. Table is tilted 90° and welding head brought into position over the V Groove.

Weldment weighs 768# and CG is 12-inches from table top. Load Torque is 768# times 18-inches or 13,824#". Fixture Load Torque 2,315#", brings Total Load Torque to 16,139#".

Operation 2. Table is flat. Remove Bolt and Crossbar. Insert disc, making certain it lies flat on fixture boss at bottom. Tilt 45° and bring welding head into place to make Weld No. 2.

Weldment now weighs 939# with CG 9.3-inches from table top. Arm is 9.3-inches plus 6-inches or 15.3-inches. Load Torque is 939# times 15.3-inches or 14,367#". The Fixture has now lost the Load Torque of the Bolt and Crossbar, 250#" and 850#", leaving 1,215#". Total Load Torque is 15,582#".

Operation 3. Table is flat. Flop weldment end-for-end. Tilt 45° and bring head into place for weld.

Weldment weighs 939# with CG 14.7-inches from table top. Load Torque is 939# times 20.7-inches or 19,437#". Total Load Torque is 19,437#" plus 1,215#" or 20,652 This is 115 percent of rating.

Use Your Ingenuity

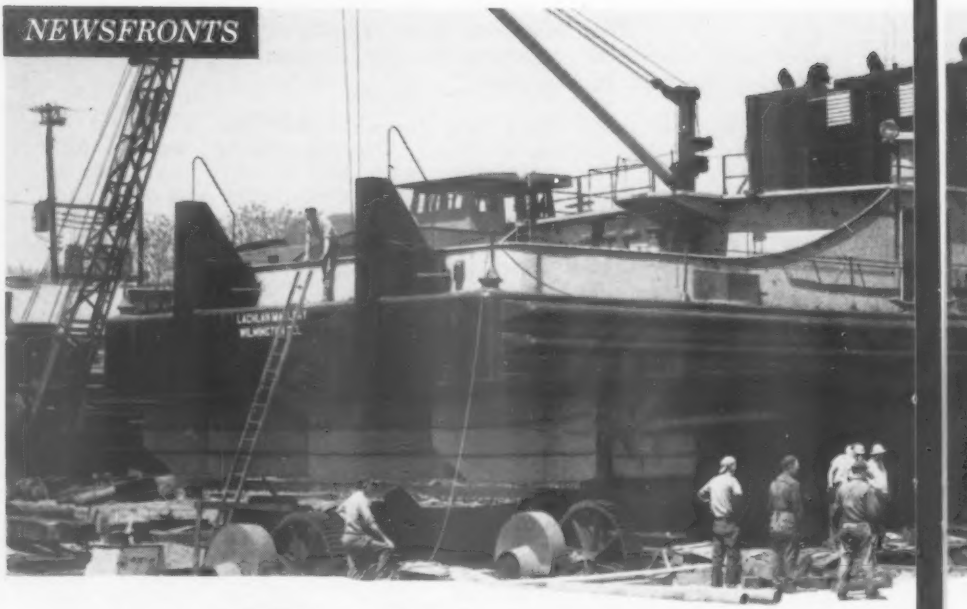
Here's how the positioner considered here can do this job safely and easily.

The base of a 45° right triangle has a length equal to .7071 times the hypotenuese. Gravity pulls straight down. Tilted 45°, the pull of gravity is affecting the length of the Arm by that amount, making the true Arm at 45° equal to 20.7" x .7071 or 14.64-inches.

Or, another way of saying it, Total Load Torque at 45° is actually only 70.71 percent of what it is at 90°. In this case, then 20,652#" times .7071 equals 14,603#" which is well within 18,000#" rating.

Inadvertently tilted to 90° won't break anything because the positioner will take 15 percent Overload now and then readily enough. The Safety Factor will protect operator from his own mistakes.

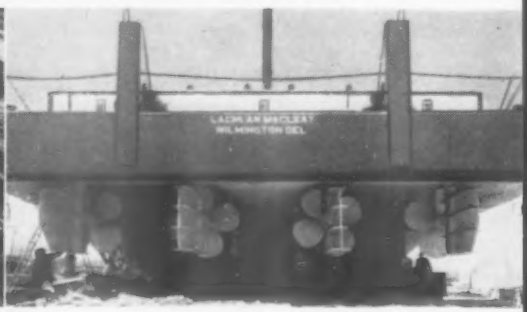
Next month: Welding Processes and Production Rates.



Built to foil a

Largest barge pusher ever built for Missouri River service. Knowing the river's way of throwing up shifting sand bars and other obstacles, St. Louis Shipbuilding built in plenty of reserve strength . . . did much of the welding with SW-10 A. O. Smith electrodes

Lachlan Macleay begins to take shape in St. Louis Shipbuilding's ways. Most welding is multi-pass on heavy gauges. The barge pusher is 165 ft. long.



Four 900-hp diesel engines turn these 78-inch steel alloy propellers. A sister ship of the Lachlan Macleay is currently under construction.

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tricky river

In addition to 3600 horsepower, the Lachlan Macleay had to have shallow draft and extra strength in hull construction.

Welding, primarily, is on ½ and ⅜-inch plate. To insure watertight welds—welds with less chance of being sprung should the Lachlan Macleay hit sudden underwater obstacles — St. Louis Shipbuilding & Steel Co. is using SW-10 (E-6010) A. O. Smith electrodes.

Similarly, if you use welding in your work you, too, can insure the quality of welds... be positive you're getting maximum strength and dependability at lowest overall cost by specifying A. O. Smith electrodes. As thousands of users can tell you, A. O. Smith quality doesn't cost, it pays — in terms of less welding time, money and trouble. Why not get the complete story from your "man from A. O. Smith" today?

The man from A. O. Smith

... Hal Costello is the A. O. Smith welding consultant who worked with St. Louis Shipbuilding. More than a salesman, he's a welding specialist, ready and eager to help with any welding problem.

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Here is the second half of a fact-filled article in which the author gives specific examples of the importance of design for welding. He shows how faulty design can cause corrosion failures and gives four rules to prevent such failures.

How to Weld Special Corrosion-Resistant Stainless Steels

by G. J. GIBSON, Welding Engineer
Alloy Tube Division
Carpenter Steel Co., Union, N. J.

THE importance of design cannot be over emphasized. Since corrosion failures are generally due to excessive metal loss in localized areas, the best design is one in which corrosion rate is uniform over the entire surface in contact with the corrodent. Localized failure is usually due to one of the following causes:

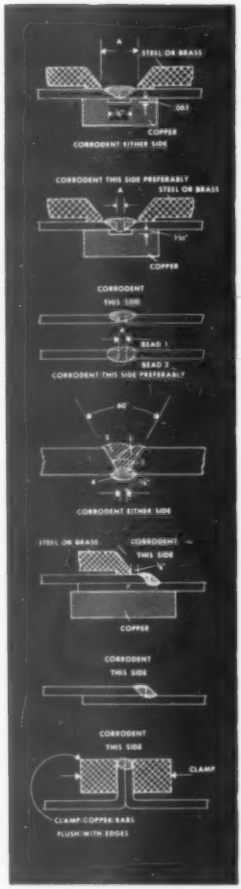
1. Unequal distribution of surface temperature which accelerates corrosion at hot spots.
2. Variation in concentration or activity of the corrodent in certain areas, particularly at liquid level lines.
3. Stagnant areas in the container such as in crevices and dead spots.
4. Velocity concentrations of the corrodent against a particular area of the container.
5. Contamination of specific areas by sediment, which acts as a corrosion accelerator.
6. Variation in the metallurgical structure of the material.

When localized corrosion occurs, the welding is frequently blamed because welds are located at points where one of these factors is the actual cause of failure. From a design standpoint, there are two types of fabricated articles for corrosion-resistant service . . . those which contain the corrodent, and those which are immersed in the corrodent. The following rules should be applied in designing containers:

1. Make the joints accessible for welding. This aids in obtaining higher quality welds.
2. The operator should be able to see the point of welding from an angle of not less than 45° from the axis of the weld.
3. Joints and seams should be welded from the inside. The inside seam should be welded last where both sides of the joint are welded.
4. Where dimensional restrictions prevent inside welding, make the weld from the outside with full penetration of the inside surface. This can be accomplished only by using a protective atmosphere at the inside of the joint or by backing up the inside of the joint with a metal chill bar.

Immersed parts should be de-

Design of Joints–Members in line



Preferred Process	Thickness	Dimension A	Remarks
1 IA	24 ga. 20 ga. 18 ga. 16 ga. 14 ga. ⅛ in.	½ ½ ⅝ ¾ ¾ 1	Welded from one side in one pass manual or automatic flush joint without filler wire. Reinforce joint with filler wire.
1 MA 2 IA with filler	18 ga. 16 ga. 14 ga. ⅛ in.	0 0 1/32 3/32	Fixture dimensions same as above. Welded from one side in one pass.
1 MA 2 IA with filler	18 ga. 16 ga. 14 ga. ⅛ in. 3/16 in.	0 0 1/32 1/16 ⅛	Joint assembled by tack welding—not welded in fixture Root side grooved to sound metal before welding.
1 MA	min. 3/16 in. max. ½ in.		Use as many beads as required to fill groove without weaving. Root side grooved to sound metal before welding.
1 MA 1 IA	min. 20 ga. max. ⅛ in.		Lap weld easy to make contact with copper chill bar must be continuous.
1 MA 2 IA	min. 18 ga. max. ¼ in.		Welded without clamps but after tack assembly.
1 IA	min. 24 ga. max. 14 ga.		Best joint for thin gauges.

IA—Inert-arc process: MA—Metal-arc (coated electrodes)

The joint design data presented here applies to thicknesses up to 11 gauge maximum. Welding joints for thicker sections are the same as for the 18-8 steels, except that the four weldability rules apply (see August Issue, Industry & Welding) concerning the welding limitations for No. 20Cb.

Design of Joints–Members at right angles

Min. size of fillet, lap and butt welds is the metal thickness.

Preferred Process	Thickness Range	Remarks
1 MA 2 IA with filler	Min. 14 ga. No max.	Lighter gauges may be fillet welded with copper bars behind and under weld.
1 MA 1 IA	Min. 20 ga. Max. 14 ga.	Light gauges must be welded with the flange clamped.
1 MA 2 IA	Min. 14 ga. Max. ¼ in.	Preferably weld the outside bead first.
1 MA 2 IA	Min. 20 ga. Max. 14 ga.	Light gauges must be clamped.
1 IA	Min. 24 ga. Max. 14 ga.	Easiest type to weld in light gauges.

See joints in Line

The joint design data presented here applies to thicknesses up to 11 guage maximum. Welding joints for thicker sections are the same as for the 18-8 steels, except that the four weldability rules apply (see August Issue, Industry & Welding) concerning the welding limitations for No. 20Cb.

signed so that all joints and all flat contact surfaces can be sealed by welding all around. Weld sizes should be sufficient for strength plus the thickness allowance for corrosion of the part during its service life.

Assembly Methods

The choice of assembly method by welding depends a great deal upon the quantity of weldments needed. This may vary from a single specialty item to a manufactured article made by the thousands. As quantity increases, the quantity of tooling needed for economical production also increases. In fabricating by welding, assembly methods change in the following order as the quantity increases:

A. Locate the position of parts by hand measuring, and tack weld the seam progressively. Then weld manually.

B. Locate parts in fixture, hand clamp, tack weld, remove from fixture, and weld manually.

C. Locate parts in fixture, power clamp, and manually weld in fixture.

D. Power clamp parts in fixture, automatically weld in fixture.

Tack welding is necessary in most assembly methods, particularly if the weldment is large. Tack weld carefully, because these

the secret

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The little engineering gem above gives the new GASWELD R-90 Series regulators two-stage performance—at *single-stage* regulator cost!

The "cartridge" control unit maintains absolutely constant delivery pressure from full to empty cylinder. Time-taking regulator re-adjustments are completely eliminated.

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welds are usually welded over and become part of the joint. Be sure to clean off slag and remove cracked or porous tack welds by grinding before final welding. The inert-arc process is recommended for tack welding because the tacks can be kept small enough so as not to show in the finished weld.

Tacks made with coated electrodes must be cleaned and generally show as bumps in the finish when the gauge is thin. Electrodes used for tack welding No. 20Cb must be of the same material. Intervals between tack welds depends on thickness of the material. Tack welding is not practical for sheet thickness less than 18 gauge.

Spacing of tack welds should be about 1 to 1½" apart for 18 gauge sheet and should become progressively wider until it reaches about 4" for ⅛" material. Purpose of the tacks is to hold the seam in position against distortion effects of the welding heat.

Welding Dissimilar Metals

There are two conditions under which No. 20Cb is welded to other metals. One occurs where the steel extends beyond the zone of severe corrosion, and is joined to either carbon steel or another grade of stainless. Here the corrosion resistance of the joint is not critical. At this point, Type 310 stainless electrodes should be used.

The other condition is where attachments are made on the outside of containers such as a stiffening frame of carbon steel. Where the shell material of No. 20Cb is greater than ⅛", the attachments may be made direct using No. 20Cb electrodes. It is important to control the weld penetration so that no weld fusion appears on the inside of the container.

Where attachments are made to gauges thinner than ⅛", a pad of No. 20Cb plate must be attached to the shell with No. 20Cb electrodes. Then the dissimilar metal attachment must be welded to the pad using Type 310 electrodes. The pad is intended to avoid dilution of the metal in contact with the corrodent by structural material fused into the weld bead.

Welding Tubing and Pipe

Welds in pipe and tubing fall into two categories . . . one in which the pipe contains the corrodent, and the other in which the pipe is immersed in the corrodent. This second case is quite often encountered in immersion heaters for pickle tanks. Pipes and tubes which contain the corrodent are generally the most difficult to weld because it is necessary to get a fully fused weld on the inside without dropping icicles or leaving unwelded crevices. This condition calls for flushing out the pipe system with an inert gas. This in turn permits complete weld penetration without the molten steel on the inside being oxidized. A slight pressurization of about ½" of water measured by a U-gauge of this inside inert gas is helpful in preserving the contour and preventing a dropped weld bead.

Standard grooved pipe joints are used, but they should be fitted without any root openings. The first pass of weld, regardless of the thickness of the pipe, should be done by the inert-gas process either with or without filler metal. Welding without filler metal is practical when the fit-up is good, and it is considerably easier to do. On heavy wall pipe, the remainder

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Airco #20 Bronze Rod. Ideal for braze welding of steel, cast iron, malleable iron, copper, and dissimilar combinations of these metals. Airco #20 is available as a pre-coated rod using Hi-Test Flux. When this rod is purchased bare, either Hi-Test or Marvel Flux can be used for high strength welded joints.

Airco #27 Low Fuming Bronze Rod. For the brazing or braze welding of steel, cast iron, or bronze. Low fuming characteristics of this rod increase its applications in restricted areas. Recommended fluxes for use with Airco #27 are Airco Hi-Test or Marvel Flux. Flux coated rods also available.

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of the joint can be filled up with the metal-arc process.

Welds of pipe and tubing which are immersed in the corrodent do not require as critical a weld bead on the inside of the joint. However, it is necessary for the penetration to extend through most of the wall thickness. On the outside, it is necessary to have a smooth weld finish without undercutting. We prefer grinding the weld off smooth leaving a slight reinforcement as an extra measure of protection against general corrosion.

Welding Clad Material

A number of super corrosion resisting steels are furnished as a clad on carbon steel. A typical size would be ½" thick covered with, for example, 20% No. 20Cb clad. The edges of a butt joint should be bevelled on the carbon steel side at 45° down to a point $\frac{1}{16}$" above the cladding. The two edges are then butted together tightly, and the bevel filled with carbon steel electrode deposit. The stainless side is then chipped out down to the carbon steel weld, which would be slightly below the clad. This groove is then filled with No. 20Cb weld metal preferably in two or more layers.

Cleaning Welds

For maximum resistance to corrosion, the finished weldment should have a smooth weld surface and be completely free of adhering foreign particles. Since the smoothness of the weld surface depends to a large extent upon the welding process used, we suggest automatic inert gas shielded-arc welding. Parts welded by this method seldom require any treatment at the weld before being placed in service.

The ripples on welds made by the metal-arc process are accept-

able for service without finish grinding. Defects which are really detrimental in weld surfaces are crevices, cracks and overlapped contact surfaces. These imperfections should be removed by chipping or grinding, and then rewelded if necessary.

The slag coating of welds is usually hard to clean. This coating must be completely removed before being placed in corrosion-resistant service. Rough and irregular welds make the removal of this slag very difficult, particularly where the weld is not readily accessible for the normal cleaning methods.

Hand scaling hammers and wire brushes are the most common cleaning tools. Where the sheet material is ⅛" thick and heavier, a pneumatic scaling hammer or light chipper may be used. In any event, care should be exercised to avoid excessively denting the surface of the weld and the surrounding plate. This can mar the appearance as well as impair the corrosion resistance of the weld. Wire brushing is also required for a thorough cleaning along with the scaling hammers. While a wire brush may serve as a hand tool, a rotary power wire brush may be used also.

Damaging contamination can be produced from grinding wheels which had previously been used for carbon steel. Particles of carbon steel on a wheel can be deeply imbedded in the stainless so that they act as a focal point for pit type corrosion. This rusting of the weld may be avoided either by the use of stainless tools and wire brushes, or by passivating the surface of the weld by a mild pickle.

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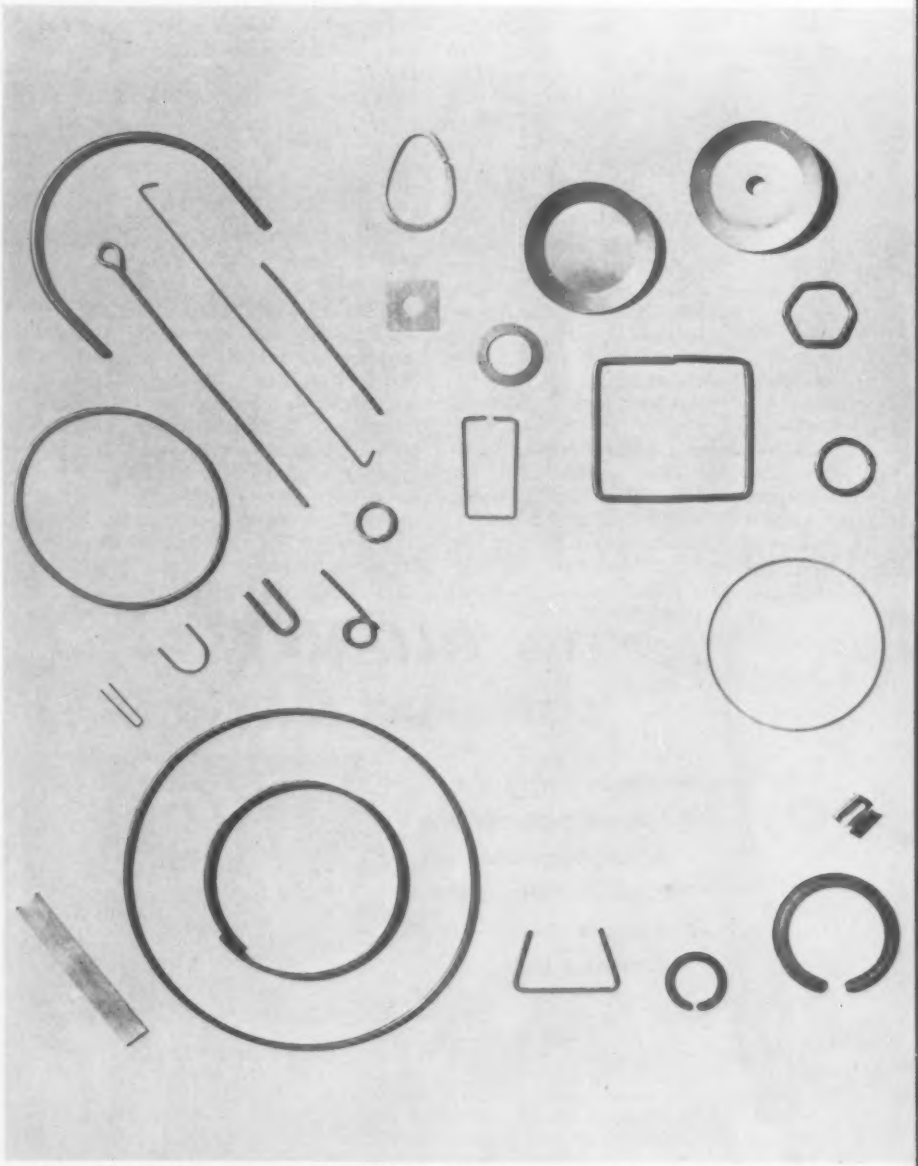


Many shapes of preforms can be tailored from silver alloy filler metals for specific applications. Excellent ductility of these filler metals permits fabricating many such shapes in the shop.

Four Reasons For Using Silver Brazing Preforms

1 *Permit choice of any type of heating method, including hand torches, conveyors or rotary tables with fixed burners, induction heaters, furnaces, and others.*

2 *Give accurate control over quantity of filler metal used per joint, thereby assuring filling the joint without waste.*

3 *Put the filler metal where it's needed, assuring uniformity and fewer rejects. For example, on joints having a large surface area or having a deep socket, preplacement assures that the filler metal flows into less accessible parts of the joints.*

4 *Eliminate need for highly skilled operators. The automatic heating methods made possible by preforms produce joints of consistent quality using operators who are trained merely to assemble parts and tend the machine.*

How To Use Silver Brazing Preforms

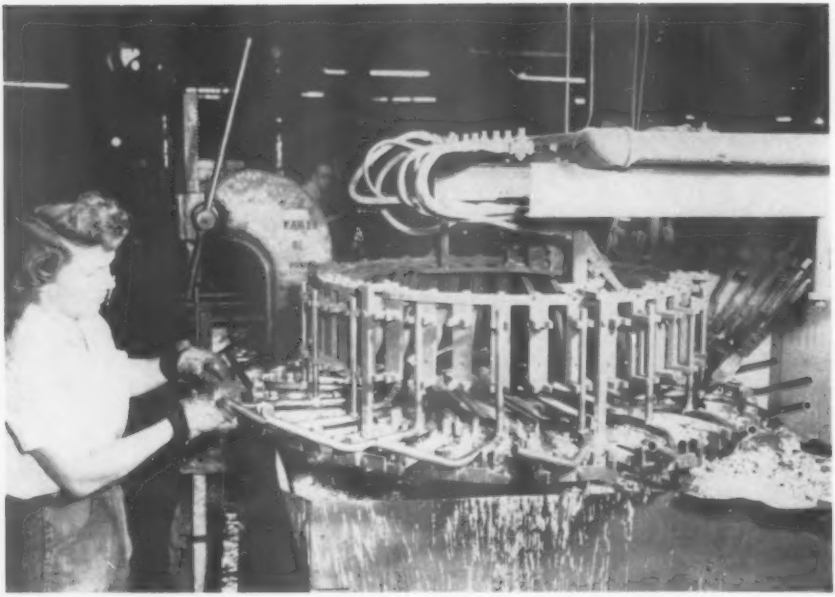
THE choice between hand feeding of silver brazing filler metal to the joint and preplacing filler metal preforms during assembly becomes an important decision for manufacturers to make. Factors influencing their decision are design and size of parts to be joined, surface regularity and size of run. In all cases, however, the advantages of the use of preforms in brazing are many, and should not be overlooked. They include: lower joint cost through mass production methods; placing the right amount of filler metal exactly where it's needed and eliminating the necessity for highly skilled operators.

Hand feeding of filler metal into the joint is usually done only with hand torch brazing. The filler metal is introduced from a length of wire or rod when the joint of the assembly reaches brazing temperature. Some of the factors which dictate the use of hand feeding are production rate, geometry of the part and size of the joint. Lack of shoulders or grooves for holding preforms or sufficient size or regularity of parts to permit ease in making and handling preforms, probably would enforce the use of the hand feeding method.

With preplacement, the filler metal is cut and shaped into a preform to conform to joint contours, and then heated so that the preplaced filler metal melts into place. It offers many advantages, provided production volume is high enough to justify the cost of fabricating preforms. Some of these advantages are shown above.

Silver Alloys Can Be Preformed

Silver alloy filler metals can be preformed into a wide variety of shapes. They may be in the form of: (1) wire rings or pieces of wire or rod bent to shape; (2) shims or thin sheet stock cut or stamped into squares or slugs; (3)



Preplaced filler metals brazes bicycle handlebars to tubular stems as table rotates past fixed burners at right. Removing brazed assemblies and replacing them with others to be brazed does not require a highly skilled operator.

flat washers or discs stamped from sheet; (4) coined washers stamped from rings of wire or of thin rod.

Most silver alloy brazing fillers flow very easily when molten, so it is often unnecessary to go to the expense of duplicating the exact shape of the joint in the preform. Thus a square piece of filler metal can frequently be substituted for a disc of equal volume, and the waste encountered in stamping out the disc is eliminated. Whenever possible, washers should be stamped from wire rings rather than punched from sheet stock.

Avoid Elaborate Shapes

Before specifying an elaborately shaped preform it is well to check whether several pieces of wire laid along the joint seam might do the same job. Because of the high ductility and formability of most silver alloy filler metals, the wire, rod and thin strip usually can be formed into rings, hairpins and other shapes simply by bending over a form of appropriate shape. Rings are commonly made by winding wire around a mandrel of proper diameter to form a coil. Then, cutting the coil longitudinally with a pair of side wire cutters produces the individual rings.

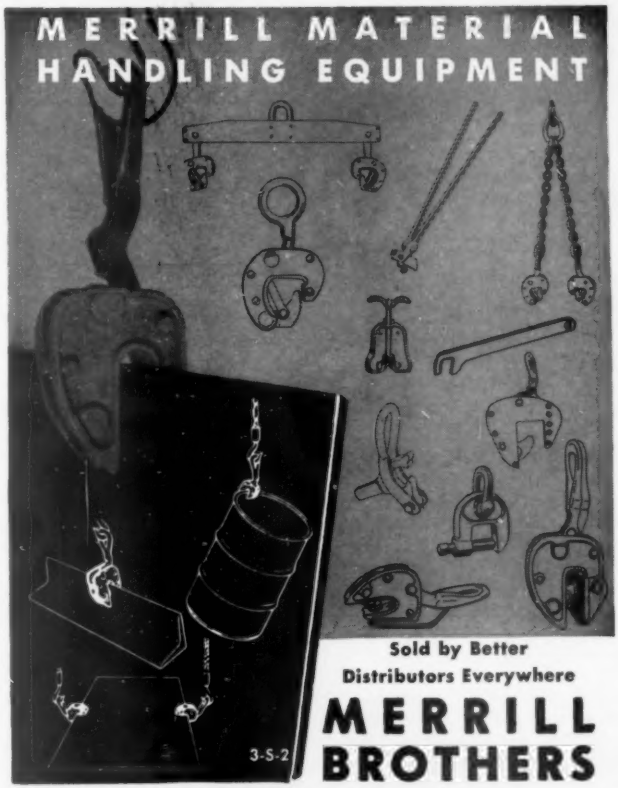
Observe These Precautions

A few simple precautions are suggested when using preforms to assure a strong dependable joint. When a shim or other preform is used for a butt joint, the members should be free to settle in place when the filler metal flows, with

the application of slight pressure if necessary, and thus squeeze out any excess filler metal and flux.

When brazing, make certain that the torch flame or other heat source does not play directly on the preplaced filler metal and melt it prematurely. In all cases the filler metal should be melted by heat transmitted by the parent metals. When heating parts of unequal cross section, more heat should be concentrated in the thicker member in order to bring it up to brazing temperature at the same rate as the thinner member. Otherwise the thinner member may overheat and buckle or distort before the heavier piece reaches brazing temperature.

Photos courtesy Handy & Harman



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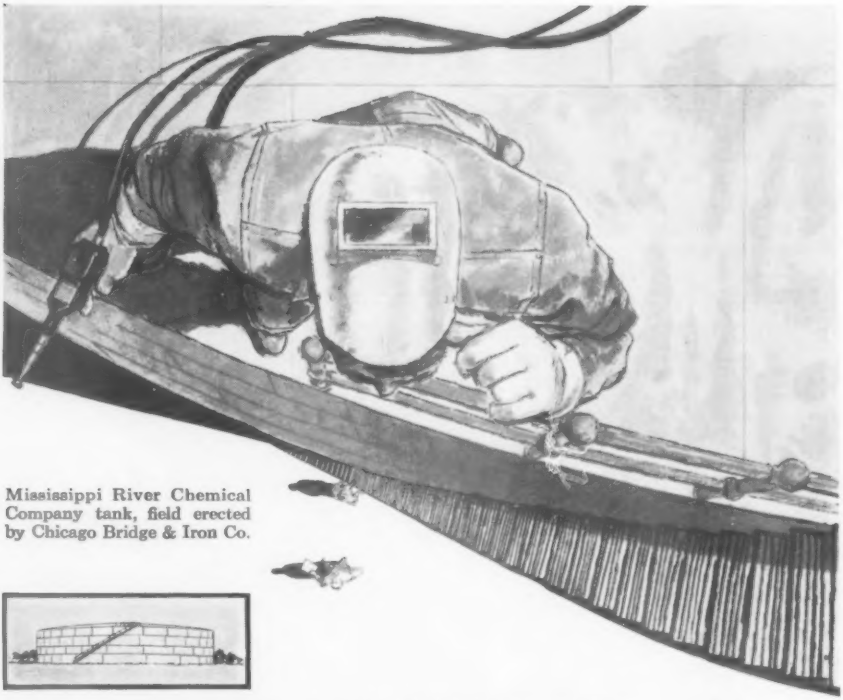

Mississippi River Chemical Company tank, field erected by Chicago Bridge & Iron Co.

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GROUP A COPPER-BASE ALLOYS

	Class 1	Class 2	Class 3	Class 4	Class 5
AMPCO	Ampcoloy 99	Ampcoloy 97	Ampcoloy 95N	Ampcoloy 86—20	Ampcoloy 92
ELECTROLOY	Electroloy A	Electroloy XX	Electroloy TX	Electroloy B	Electroloy Molin 2
MALLORY	Elkaloy A	Mallory 3	Mallory 100	Mallory 73	Elkaloy D
S-M-S	Alloy 101	Alloy 103	Alloy W-5	Alloy W-2	Alloy 116
TIPALOY	100	Tipaloy 130	Tipaloy 200	T2	T-116
W W ALLOYS	WW-1	WW-2	WW-3	WW-7	WW-8
WELDALOY	Weldaloy 10	Weldaloy 20	Weldaloy 30	Weldaloy 40	Weldaloy 50
WELDING SALES	Tuffaloy 88	Tuffaloy 77	Tuffaloy 55	Tuffaloy 44	Tuffaloy 66
AVAILABILITY	Bars Forgings	Bars Forgings Castings	Bars Forgings Castings	Bars Forgings Castings	Castings

GROUP B COPPER-TUNGSTEN ALLOYS

	Class 10	Class 11	Class 12	Class 13
AMPCO	Ampcoloy 3 W 10	Ampcoloy 3 W 10	Ampcoloy 3 W 20	Ampcoloy W-100
ELECTROLOY	Electroloy 1	Electroloy 10	Electroloy 20	Electroloy 100
MALLORY	Elkonite 1 W 3	Elkonite 10 W 3	Elkonite 20 W 3	Elkonite 100 W
TIPALOY	1	10	20	100 W
W W ALLOYS	WW-1W	WW-10W	WW-20W	WW-100W
WELDALOY	Weldtung 10CT8	Weldtung 20CT	Weldtung 30CT	Weldaloy W
S-M-S	Elkonite Alloy 1	Elkonite Alloy 10	Elkonite Alloy 20	Elkonite Alloy 100W
WELDING	Tuffaloy	Tuffaloy	Tuffaloy	Tuffaloy
SALES	1 W 3	10 W 3	20 W 3	100 W
AVAILABILITY	Bars Inserts	Bars Inserts	Bars Inserts	Bars Inserts

Alloys listed here are classified by Resistance Welder Manufacturers' Association and have been grouped for easy reference by Weldaloy Products Co.

How to Choose and Use Resistance Welding Alloys

IN all resistance welding applications the electrodes are in direct contact with the materials to be welded. They conduct the welding current to these materials, apply force to the area to be welded and dissipate a part of the heat of welding.

Electrical and Thermal Properties

Resistance welding electrodes carry extremely high electric currents, current densities ranging from 5000 to 70,000 amps per square inch. Since the quantity of heat developed in metal conductors is directly proportional to the square of the current, time of current flow and resistance of the path, it is obvious that an electrode should have relatively high electrical conductivity to minimize heating. In fact, electrical and thermal conductivities must be sufficiently high so that heat generated at work and electrode face will be readily dissipated, preventing these surfaces from fusing.

In resistance welding operations, welding pressure on the electrode may range from 10,000 to 60,000 psi. In addition, there may be considerable impact when the electrodes are brought together on the work. To minimize deformation of the electrode face, electrode must be made of a material having high mechanical properties (hardness, yield strength, etc.) particularly at elevated temperatures.

Commercially pure copper is an excellent electrical conductor. However, certain copper alloys have higher annealing temperatures, greater compressive strength and better wear resistance. These desirable mechanical properties are obtained at some sacrifice in electrical and thermal conductivities. This suggests selection of an electrode material that has the least conductivity that will produce good welds on a given application, so as to take advantage of the greater wearing properties. It should be noted that if conductivity is too low, sticking or alloying of the electrode face is experienced, particularly in spot and seam welding.

Group A—Copper-Base Alloys

Class 1 alloy is recommended as a general-purpose material for spot welding electrodes, seam welding wheels, seam welding machine shafts, projection welding electrodes, flash, upset and percussion welding dies and fixtures.

It is specifically recommended, because of its high electrical and thermal conductivity, for spot welding aluminum alloys, magnesium alloys, coated materials (terne plate, tin plate, galvanized iron, cadmium plate) brass and bronze. This alloy is work-hardenable and is not available in cast form.

Class 2 alloy is a cold-worked, age-hardened (heat-treatable)

material with higher mechanical properties and somewhat lower electrical and thermal conductivities than Class 1. It is used for those applications requiring moderately high electrode force but with high thermal conductivity.

This alloy is used for spot, seam and projection welding of clean mild steel, low-alloy steels, stainless steels, low conductivity brasses and bronze, white brasses, nickel and nickel alloys. It may also be used for seam welding machine shafts and bearing, flash, upset and percussion welding dies and current carrying structural members.

Class 3 alloy is a cold-worked, age hardened (heat-treatable) material with still higher mechanical properties and lower conductivities than Classes 1 and 2. It is used primarily for projection welding electrodes, flash upset and percussion welding dies, current carrying shafts and bushings for seam welding.

Because of its low conductivity, it is not generally recommended for use as spot welding electrodes, but may be used advantageously for spot welding materials having high electrical resistance, such as stainless steels and Inconel.

Class 4 alloy is a cold-worked age - hardened (heat - treatable) material having extremely high hardness and tensile strength, although the electrical conductivity is lower than that of the Class 3 alloy.

It is generally recommended as electrode material for special flash and projection welding applications where pressures are extremely high and wear is severe, but where heating is not excessive. It is used frequently in the form of inserts and die facings and for seam welding machine bushings. It is also available in cast form.

Class 5 alloy is available principally in the form of castings having high mechanical strength and moderate electrical conductivity. It is recommended principally as a high strength backing material for other resistance welding electrode materials, flash welding dies, and as high strength current carrying structural members of resistance welding equipment, such as secondary circuit arms, knees, platens, etc. It may be used to advantage as structural or current carrying members in resistance welding fixtures where high strength, wear resistance and nonmagnetic properties are required.

Group B—Copper-Tungsten Alloys

The Group B electrode materials are mixtures of copper and tungsten made by powder metallurgy processes. Since they are not true alloys, as those in Group A, they do not respond to heat treatment, nor can they be cold worked.

Their mechanical properties and conductivity are a function of the percent of copper and tungsten employed, hence are not reduced by the heat of welding. Commercially pure tungsten and molybdenum used for electrode materials also fall into this Group (Class 13). These materials are used as facings or inserts because of their superior wear resistance and because they can be brazed without destroying their desirable properties. When used in this manner,

back-up piece must be a higher strength material than the pure copper conductor.

These alloys are not generally used for spot or seam welding because of their low conductivity. However, they are useful where the base material being welded has high resistance (stainless steel or Inconel) or where a heat balance is necessary.

The Group is divided into classes 10, 11, 12 and 13 which have ascending orders of hardness and descending orders of conductivity.

This article is based on work done by the Resistance Welding Committee, American Welding Society, and is abstracted from "Resistance Welding, Theory and Use" published by Reinhold Publishing Corp., 430 Park Avenue, New York City.

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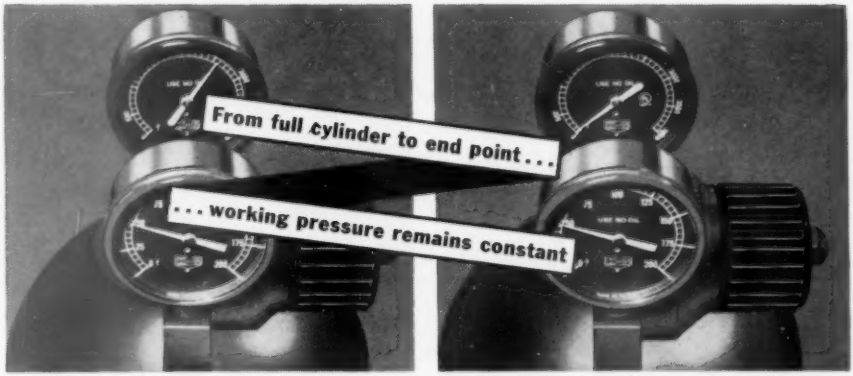

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National Advisory Committee on aeronautics reports that vacuum brazing results in good joints with 63,000 psi shear strengths as compared with 42,000 psi for the same joints processed in dry hydrogen. This is a fifty percent increase in strength.

Brazing Under A Vacuum

Preformed brazing alloy is positioned and jet engine parts mounted in suitable fixture prior to brazing. Temperatures are checked by thermocouples.

VACUUM brazing is currently being investigated by a number of firms in this country and holds promise of becoming an increasingly important production process.

By brazing under high vacuum, in an atmosphere free of oxidizing gases, a superior product, with greater strength, ductility and uniformity may be obtained economically.

The National Advisory Committee on Aeronautics, in Technical Note #3450, "Preliminary Investigation of Properties of High Temperature Brazed Joints, Processed in Vacuum or in Molten Salt," published recently, reports that vacuum brazing results in good joints having shear strengths in the order of 63,000 psi, as compared with 42,000 psi for the same joints processed in dry hydrogen. This is a 50 percent increase in strength.

Pratt & Whitney Aircraft division of United Aircraft Corporation, East Hartford, Conn., is typical of the firms carrying on investigations of this new process. The Connecticut aircraft engine builder has pioneered in exploring the application of vacuum brazing to the production of jet engine components,

Tight vacuum seal is provided by water-cooled O-ring seals. Furnace shell (which contains heating element) is lowered over retort which encloses work.

such as fuel manifolds, using a recently installed vacuum furnace made by F. J. Stokes Machine Co.

Interesting Test Results

Pratt & Whitney's tests have shown where copper was used as the brazing material, quantitative shear strengths of joints formed in stainless steel and nickel alloy test pieces by brazing in vacuum, hydrogen and dissociated ammonia were similar, showing no pronounced superiority for the vacuum-brazed joints.

Peel tests showed that vacuum brazing of stainless steel to nickel-base alloy produced tough, ductile joints which were estimated to be more ductile than those obtained by brazing in normal atmosphere.

How to Vacuum Braze

For vacuum brazing, components are mounted on suitable fixtures and "wired" for brazing. This involves placing one or two turns of brazing wire around each joint. They are then enclosed within the furnace — a double-shell vacuum chamber which is lowered into position from overhead by means of vertical tubular guides. The space within the retort, or inner shell of the chamber, may be evacuated to a pressure of 0.05 micron or less.

Resistance-heating elements supported by the outer shell and located in the space between the two walls of the furnace, raise the internal temperature of the retort to about 2150°F. Brazing wire melts and infuses deeply and thoroughly into the tiny crevices of the joints between the tubes and the fittings of the assembly—thanks to the high vacuum which has been drawn.

When it cools, the brazing alloy solidifies and joins the several elements with uniformly strong, permanent joints.

Versatile Vacuum Furnace

Specially designed vacuum furnace installed at Pratt & Whitney is the first such unit to be built which is designed for large-scale production of these components. It has features which makes it usable also for vacuum heat treating and degassing; it can also be used for brazing in other inert-gas atmospheres, and at normal pressure without vacuum. Double-wall construction, for example, prevents

(Continued on Page 119)

TABLE I

PREHEAT RECOMMENDATIONS

Type of Steel	Preheats to be Applied	
	Before Tack Welding	Before Butt Welding (Note: This interpass temperature is also to be maintained during welding)
C-Mo	70 F Min.	70 F to 400 F
1% Cr-½% Mo 1¼% Cr-½% Mo	150 F Min.	300 F to 600 F
2¼% Cr-1% Mo 3% Cr-1% Mo 5% Cr-½% Mo	250 F Min.	400 F to 700 F

NOTE: In general, the higher temperatures within the specified ranges should be used for heavier thicknesses and more complex structures.

IN the construction of industrial piping systems, particularly for steam power generation, it often becomes necessary to make welded joints between metals of different chemical compositions.

These recommended practices are intended to serve as a guide in developing procedures which will insure satisfactory mechanical properties in the welded joints and comply with the requirements of the various codes. Developed by the Pipe Fabrication Institute, Pittsburgh, Pa., these recommendations are not to be considered mandatory. Factors, such as joint design, service temperature, thermal fluctuations, steel making practice, electrode characteristics, welding techniques, ambient temperature and elapsed time before post-heating, may require modification of the practices suggested here.

At present there is some difference of opinion among engineers in regard to exact postheat procedures which should be followed for the various alloys.

In general, these recommended practices represent conservative measures introduced to minimize the danger of crack formation during welding resulting from the air hardening characteristics of some of these steels.

Following ferritic steels are commonly employed for industrial piping:

(a) carbon steel
(b) carbon-molybdenum steel
(c) 1% moly steel
(d) 1¼% chromium—½% moly steel
(e) 2¼% chromium—1% moly steel
(f) 3% chromium — 1% moly steel
(g) 5% chromium — ½% moly steel

Welded joints may be composed of any two of the materials listed above. Preheating requirements should be governed by those for the higher alloy steel as shown in Table 1.

Welding Techniques

Select Electrodes Carefully

Electrode used for welding dissimilar metal joints may be chosen to give deposited metal of the same nominal composition as either of the base materials or of an intermediate alloy content.

Selection of weld metal analysis should receive careful consideration if the dissimilar metal joint is to be exposed to heat-treating or

TABLE II

POSTHEAT RECOMMENDATIONS

FOR DISSIMILAR FERRITIC STEEL COMBINATIONS

	C-Mo	1% Cr–½% Mo 1¼% Cr–½% Mo	2¼% Cr–1% Mo 3% Cr–1% Mo	5% Cr–½% Mo
Carbon	1150 F to 1300 F	1150 F to 1350 F	1150 F to 1400 F	1150 F to 1400 F
C-Mo		1200 F to 1350 F	1200 F to 1400 F	1200 F to 1400 F
1% Cr–½% Mo			1275 F to 1400 F	1275 F to 1400 F
1¼% Cr–½% Mo				
2¼% Cr–1% Mo				1300 F to 1400 F
3% Cr–1% Mo				

NOTE 1: The holding time shall be a minimum of 1 hour per inch of wall thickness but in no case less than 1 hour.
NOTE 2: In the case of joints between carbon and carbon-molybdenum steels, stress relieving is not required when the carbon steel has a carbon content under 0.35% and a wall thickness under ¾" and the carbon-molybdenum steel has a wall thickness under ½".

for Joining Dissimilar Steel Piping

service temperatures where significant carbon diffusion occurs. In general, low hydrogen lime-type electrodes of the AWS-ASTM classifications EXX15 and EXX16 are preferred.

Standards for Welding

Welding of dissimilar metal joints, other than those containing 2¼% Cr—1% Mo, 3% Cr—1% Mo, or 5% Cr—½% Mo, may be interrupted at any time if two precautions are observed. The first is that a minimum of at least ⅜-inch thickness of weld deposit or 25 percent of the welding groove is filled (whichever is greater). The second is to allow weld to cool slowly from welding temperature to room temperature. A suggested means of retarding cooling is to wrap the weldment with asbestos paper and allow the joint to cool in still air.

Welding of 2¼% Cr—1% Mo, 3% Cr—1% Mo and 5% Cr—½% Mo steels may be interrupted at any time provided that recommended pre-heat temperature is maintained until welding is resumed. If condition is not met, partially completed weld should be immediately partially stress relieved at a minimum temperature of 1200° (but below 1400°F) for at least 30 minutes.

In all cases, welds must be at

"Proper preheating and postheating techniques can minimize danger of weld cracking when joining dissimilar steel piping."

preheat temperatures before welding is resumed.

How to Stress Relieve

Completed welds may be stress relieved either locally or in full furnace heats. It is important that temperature be raised slowly and uniformly in the region being treated. Cooling after stress relieving may be accomplished by allowing the treated zone to cool uniformly in the furnace or in still air.

Temperature range for effective stress relieving tends to be limited on its upper end by the critical transformation range of the lower alloy material and on its lower end by the properties developed in the higher alloy steels.

Recommended stress relieving temperature ranges for complete stress relief of various ferritic steel combinations are shown in Table 2. Choice of a specific temperature represents a compromise between the necessity of softening the higher alloy steel at the expense of scaling, spheroidization and pos-

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sible distortion in the lower alloy.

Completed welds in 2½% Cr—1% Mo, 3% Cr—1% Mo and 5% Cr—½% Mo steels should be either immediately partially stress relieved at a minimum temperature of 1200°F (but below 1400°F) for at least 30 minutes, or immediately completely stress relieved in the temperature range given in Table 2.

If the welded section has been given partial stress relief, it should subsequently be given the complete stress relief in accordance with Table 2.

Mansol Now Makes Silver Brazing Preforms

Mansol Ceramics Co., Belleville, N.J., has announced opening a division of the company for production of silver brazing preforms. These will be made either to a standard silver formula or can be made of nearly any analysis of the alloy.

In addition to silver brazing preforms, Mansol is manufacturing brass and copper preforms.

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HERRICK Builds The Best Ram Type Welding Head Manipulators

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Steel food containers, to be lined with a protective coating, must be free from welding imperfections. Careful selection of welding electrodes and adherence to proper welding technique is the way it's done.

How to Plan for Quality Welding

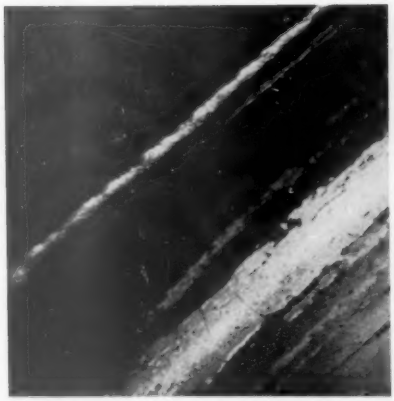
by GERALD SCHAUERTE

FOOD handling and processing equipment fabricated by A. M. Harris, Inc., Cincinnati, Ohio, and subsequently lined with a thermosetting protective coating, has recently been approved by the U.S. Government for use in federally inspected food plants. The successful application of a coating that will meet rigid requirements demands the utmost care in preparation of all surfaces of the metal, especially welded seams.

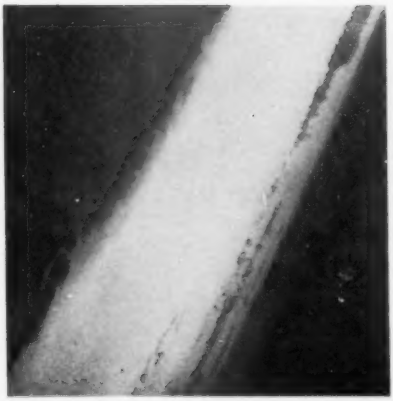
Require High Quality Welds

Welds must be extremely dense in structure and without pinholes, blowholes, undercuts, porosity or any other type of welding imperfections. To insure economical production costs, electrodes must deposit the weld metal with a minimum of spatter. A. M. Harris, Inc. solved the welding problems involved in fabrication of this equipment after exhaustive testing and experimentation, by selection of suitable grades of electrodes and adherence to proper welding techniques.

Equipment fabricated for meatpackers includes handling trucks, tanks, trays, scales, smokehouse doors, conveyors and curing vats.



AS-WELDED. Seam has dense structure and flat contour. Welds must be free from excessive spatter and defects.



AFTER GRINDING. Seam area of vat interior is blasted in preparation for application of protective coating.

In welding seams of curing vats, the primary objective is attainment of a dense weld metal structure. For this application AWS Grades E-6013 and E-6024 electrodes are used. These not only comply with requirements as to density of structure, but also produce a flat bead which helps to reduce grinding time.

The E-6024 contact-type electrode with iron powder coating combines a very high rate of deposit with extreme ease of operation. Higher currents can be used than with other types. Spatter is practically nil, sidewall wash is excellent, and the slag is self-removing or only slightly adherent.

Type E-6013 electrodes are quiet in operation, with minimum spatter and good arc direction and stability. Weld metal is ductile and free from porosity.

Weld in Flat Position

Most of the welding is done in the flat position, although some vertical welds have to be made. Welding positioners, specially designed to A. M. Harris specifications, are used to facilitate downhand welding. No preheating or post heating is needed, as the thicknesses of metal are not heavy enough to require it.

Grind Welds Smooth and Flush

Preparation of welded seams for applications of the coating is as important as obtaining a weld metal deposit of suitable properties and characteristics. All welds must be ground perfectly smooth, and flush with the parent metal. Both rough and finish grinding are employed; depressed center, semiflexible discs are used for the finish grinding stage.

After welds are ground smooth and level, all metal surfaces to be coated are sand or grit blasted to a bright finish. This is the ultimate test of most welds for if the weld structure is not extremely dense, tiny pinholes will be disclosed during the blasting operation. Many types of electrodes have been rejected for failures occurring at this stage.

When preparation of the metal surface has been completed, the

Use of type E-6020 electrodes, with heavy, all mineral-type coating, assures tight seal to prevent moisture or harmful bacteria from collecting behind reinforcing beams.

coating is applied. This protective coating is a thermo-setting material which is applied in a minimum of five successive coats until a final film thickness of 8 to 10 mils is built up. After each separate spraying, the item is moved into a baking oven and the coating set with heat. The final layer is given a special high temperature cure for two hours at 500F. Rigid inspection procedures must be carried out throughout the manufacturing process.

Fabricate Other Weldments

Another type of equipment in which welded fabrication plays a critical part is the fermenting cellar used in breweries. Lined tanks, vats and containers of several types are used for beer fermentation and storage. The fermenter, however, is of special interest from a welding standpoint because this vessel is designed for use at a working pressure of from 5 to 7 pounds.

The rectangular fermenter is welded from $\frac{3}{16}$-inch to $\frac{3}{8}$-inch steel plate, depending upon its size and capacity. After welding, interior seams are ground smooth and flush, and interior surfaces prepared for coating in the same manner as the curing vats previously described. Operating pressures employed however, demand an even higher standard of perfection in welded joints. Electrodes selected for the seams of the fermenter body are AWS Grades E-6013 and E-6010. The 6010 electrode produces high quality welds in all positions. Deposition rate is high, spatter is low, and structural

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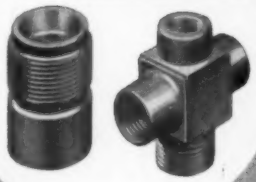
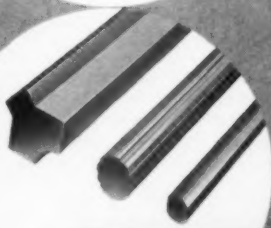


Brass Forgings

Extruded Brass Shapes



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density and freedom from porosity meet the exacting requirements of this service.

Reinforcing beams on the bottom and sides of the tank exterior must be seal welded perfectly tight to prevent any moisture or harmful bacteria from collecting behind these members. This is an absolute "must" in a fermenting cellar.

AWS Grade E-6020 electrodes, with their heavy all mineral-type coating are eminently suited to this service. They provide high quality downhand welding at high speed. Arc action is forceful and penetrates deeply. The deposit is highly ductile, of dense structure and free from porosity.

In addition to the food containers, A. M. Harris, Inc. fabricates a variety of equipment for general industrial use. All require the same surface preparation, and the same degree of perfection in welded seams.

Note: The author of this article is a Field Engineer with the Metal and Thermit Corporation.

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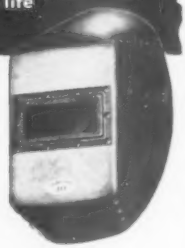

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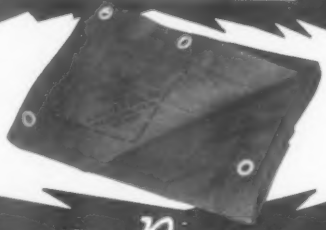

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Alcoa Offers Handbook

One of the most comprehensive reference handbooks on aluminum ever to be compiled is available from Aluminum Company of America. Entitled the "Alcoa Aluminum Handbook," the new booklet provides an up-to-date successor to the now discontinued "Alcoa Aluminum and Its Alloys."

Book presents data on aluminum alloys and mill products in an easy-to-read tabular form. There is little text. Included is information on alloy standards as well as the properties, sizes, and tolerances of mill products usually produced from them. The code numbering system employed to designate alloys and their modification is also explained.

Subsequent sections in the 176-page book deal with wrought alloys; sheet and plate; wire, rod, and bar; extrusions; tube and pipe; electrical conductor; structural shapes; forgings, and casting alloys. In all, 140 tables tell the Alcoa story.

Copies of the "Alcoa Aluminum Handbook" are available by writing on company letterhead to Aluminum Company of America, 781 Alcoa Bldg., Pittsburgh 19, Pa.

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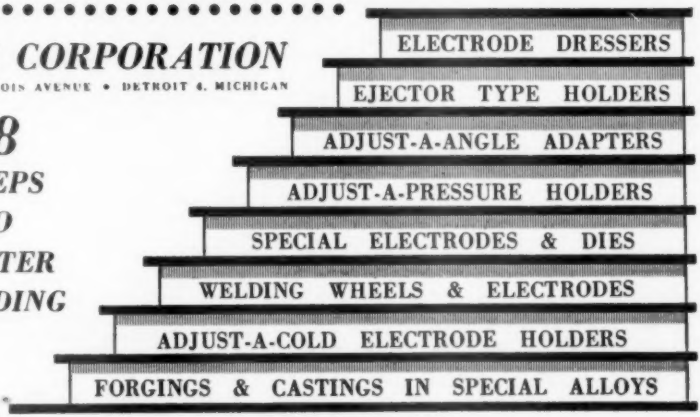
8 STEPS TO BETTER WELDING



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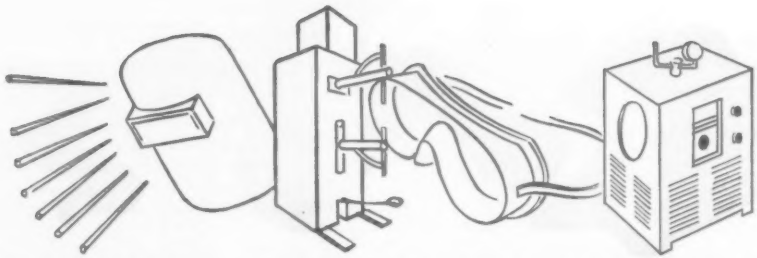

NEW PRODUCTS

Hardfacing "Tube Rods"

A new line of "tube rod" electrodes specially developed for semi-automatic hardfacing has been announced by American Manganese Steel Division, American Brake Shoe Company. The new electrodes are 3/32" diameter drawn

tubular wire with the various alloys enclosed within a wire shell.

Manufacturer claims electrodes act like mild steel solid wire in the welding machine and will not deform or snarl during welding. Gains in high metal deposition, longer wear life of parts and speed and ease of welding are said to result from use of "tube rods."

Specific "tube rods" are available for manganese steel and repair applications, heavy impact and abrasion jobs, and applications where exertmely high abrasion resistance is required.

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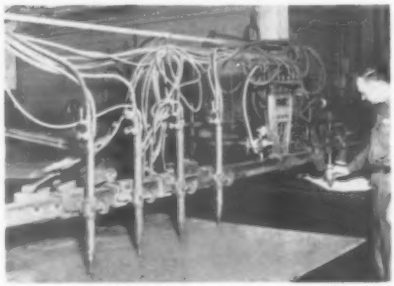
FOR ADDITIONAL INFORMATION
Use Reader Service Card for additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail—no postage required.

Automation in Flame Cutting

A new flame cutting system which brings automation to the cutting operation has been developed by Harris Calorific Co. Called "Cut-O-Mation," the system utilizes up to eight of the company's 98-T machine torches in combination with an oxygen saver.

Combination of the two is said to increase cutting speeds up to 50 percent, reduce oxygen consumed in preheat up to 80 percent, lower overall oxygen consumption as much as 20 percent and reduce slag to a minimum.



The oxygen saver establishes a full, vigorous preheat flame which permits edge starting or piercing to be done faster than before. Once cut is started, flame is reduced by moving control lever. Full preheat flame can be restored by moving same lever.

"Cut-O-Mation" is said to be best suited for use with natural gas or propane, but can be used with any of the popular fuel gases: Acetylene, hydrogen, natural or L-P gases.

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Phoson solves "hidden joint" assembly brazing problems!

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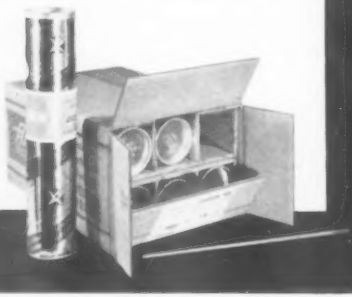
THE FABRICOR SERIES

Especially developed for DC reverse polarity welding of heavy stainless. Available in the following types: 308, 309, 310, 316, 347; sizes $\frac{1}{8}$" to $\frac{1}{4}$".



Good news for every user of stainless electrodes

AEROCOR and FABRICOR identify America's newest DC welding electrodes.

To users they offer an opportunity for faster, easier welding. They've been especially designed for quality welds with the benefits and properties you want most.

For example, on every job, AEROCOR and FABRICOR Electrodes offer you these advantages:

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- **Smooth, even-rippled weld beads**
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AEROCOR and FABRICOR are manufactured to the same high standards as all ARCOS Stainless Electrodes. And they're packaged in the famous Arcos ELECTROPAK — the easy-to-open-and-reseal container that protects against moisture pick-up and chipped coatings. Both series are identified by a bright orange colored label. Available through your Arcos representative or distributor.

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Magnetic Plate Clamp

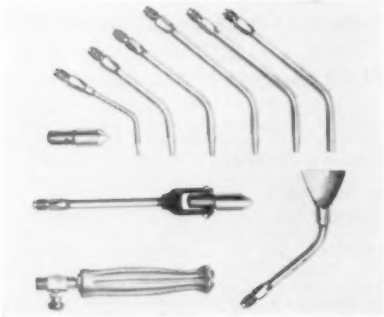
A powerful new magnetic plate clamp recently introduced by Buck Mfg. Co. is said to deliver 3¼-tons of direct lift - off strength from a 9-inch diameter base. This strength is now available in the PC-6, a companion model to the BUX PC-4 which delivers 3,000 pounds lift-off pull.

Weighing only 80 pounds, the unit is designed for use in ship and railroad yards and at steel erections sites where very heavy steel plates are to be welded. Unit will operate on 120 or 220 volt AC or DC power source.

Circle No. 64 on Reader Service Card.

Soldering and Brazing Torch

Unusual versatility is featured in the Model "A" soldering and brazing torch manufactured by Huber Industries, Inc. A handy, portable tool with almost limitless uses, torch is made entirely of Revere brass, except for stainless steel



conical valve system and form-fitting wooden handle.

Ready to connect, Model "A" has nine different tips, which produce everything from a very fine flame to a broad burner. Unit may also be fitted with a soldering iron tip.

Circle No. 105 on Reader Service Card.

Portable X-Ray Tubes

Five new industrial x-ray tubes designed for light-weight, self-contained portable X-ray tube heads, have been developed by Matchlett Laboratories, Inc.

For replacement or for new equipment, the PR series tubes are said to make it possible to select the optimum combination of tube voltage and focal spot size to achieve maximum radiographic quality with minimum exposure time.

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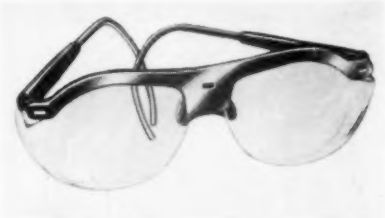
Smooth Goggle Hook Temples

New pastic, Smooth-Hook Temple is announced by the Watchemoket Optical Co. Hooks are said to rotate smoothly



and continuously through 360° and telescope in and out to enable perfect fit by the wearer without the use of tools. The plastic used is claimed practically unbreakable.

Circle No. 169 on Reader Service Card.

Fast-Acting Control Valves

A new line of Quick-As-Wink "B"-type control valves has been introduced by C. B. Hunt & Son, Inc. Valves are said to include such features as a shock resistant mounting for the solenoid that reduces hammering and vibration, prolonging solenoid life, pilot operated solenoids requiring low amperage and simplifying electrical control circuits, and override button permitting manual operation where required.

Valves come in single or doube solenoid, also lever and single and double piloted design.

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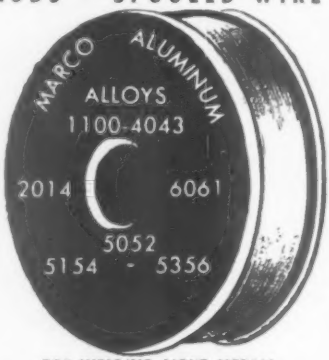

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Hard-Facing Flux

A new dry-type welding flux for use when applying nickel and cobalt-base hard-facing alloys to hard-to-weld metals is now available from Wall Colmonoy Corporation.

Called Colmonoy Flux 6-20, the new material is claimed to impart good flow characteristics to hard-facing alloys. Designed to include a unique eye-saving formula, it contains no glare-producing salts. The new flux was developed for use in hard-facing iron and nickel-base alloys containing chromium, titanium and/or aluminum and cast iron parts.

Circle No. 171 on Reader Service Card.

Impact-Type Spot Welder

An impact-type spot welder designed to weld silver contacts is now available from Taylor-Winfield Corp.

The welder is said to have pneumatic impact head which permits extreme forging pressure to achieve maximum set-down of work without excessive electrical power demand. Special controls allow independent set-up welding and forging actions.

Circle No. 170 on Reader Service Card.

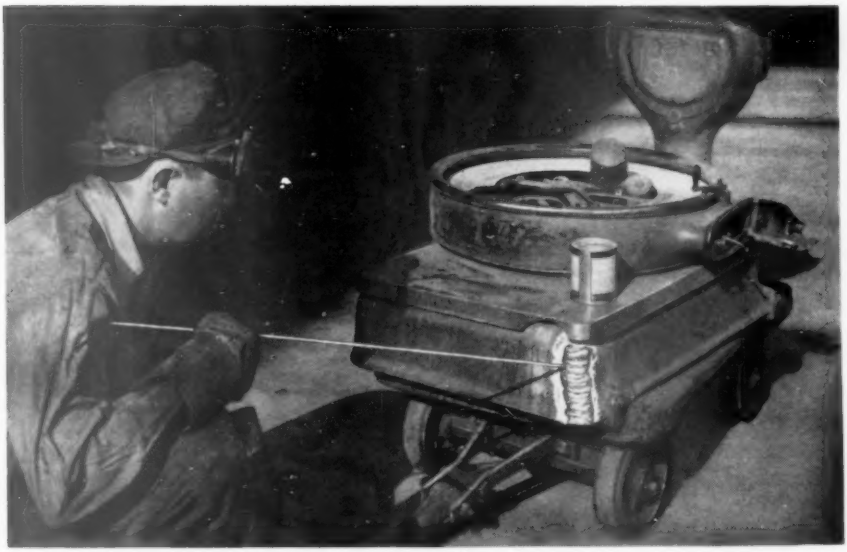
Weld Surface Thermometer

A new product ideally suited for the welding industry is this handy little thermometer which can be laid on metals to be welded—it stabilizes in 60 seconds. Stainless steel unit has a range of from 50°F to 1000°F.

Developed by Pacific Transducer Corp., the Spot Check Surface Thermometer can be used for determining the temperatures on hard surfacing welds, for preheating of all metals, to be welded, for watching maximum temperatures on metals such as manganese, for preheating magnesium and for watching temperatures on high carbon steels.

Unit is calibrated to within plus or minus 2 percent and can be reset by the user at any time. Diameter is 1¾-inches overall and weight is about 5 ounces.

Circle No. 172 on Reader Service Card.



SAVE COSTLY REPLACEMENTS

...get fast, strong repairs with Bridgeport No. 192 Low-Fuming Bronze Rod

This scale was a vital link in a plant's materials weighing section. Operations slowed down when its cast iron frame was smashed. Braze welding with Bridgeport No.192 Low-Fuming Bronze Rod had it back on the job good as new in a matter of hours... another example of time and money saved through repair with braze welding.

Bridgeport No. 192 is a low-fuming manganese-type, all-purpose rod recommended for both repair and production welding. It tins readily and the base metal needs relatively little local preheating, thus avoiding brittleness. Many repairs are possible without disassembling or moving heavy equipment. And welds are frequently stronger than the base metal.

Write today for your free copy of Bridgeport's new booklet, "Bronze Welding Alloys."

BRASS Bridgeport CO.

BRIDGEPORT BRASS

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Bridgeport Brass Company, Bridgeport 2, Conn. • In Canada: Noranda Copper and Brass Ltd., Montreal

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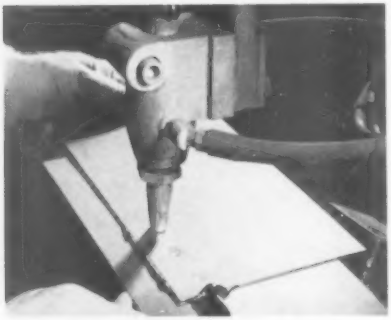
Circle No. 62 on Reader Service Card.

Spot Weld Sealer

A spot weld elastic sealer compound introduced by Parr Paint & Color Co., is said to increase electrode service life by 500 percent. Compound is said to eliminate electrode failure caused by formation of copper oxide which occurs when tip comes into contact with ordinary spot weld compounds.

Elastic sealing compound provides watertight, corrosion-free joints with minimum resistance to welding current,



the manufacturer claims. Satisfactory welds are made with spot welder set to standard conditions of 10,000 amps, 10 cycles.

Compound will adhere to oiled sheets without running or sagging and will hold its form at temperatures of 350° F for 45 minutes. It may be applied with conventional pressure compound equipment at 60 psi. It may be extruded in beads as small as ⅛-inch, can be used where degreasing and bondering equipment is used and is not susceptible to attacks by salt water.

Circle No. 35 on Reader Service Card.

CIRCLE NUMBERS ON THE CARD AND MAIL!

Electrode Storage Oven

A new model Aridair electrode stabilizer has been introduced by Fred C. Archer, Inc. So necessary for storage of low hydrogen powdered iron electrodes which are susceptible to moisture pick-up, new model incorporates several changes but retains popular twin chemolectric dehydrators along with electric heat and thermostatic control from 150° to 550°F.

Circle No. 177 on Reader Service Card.

Portable X-Ray Unit

A new portable x-ray unit that fits into the trunk of an automobile is available from the Research & Control Instruments Division, North American Philips Co., Inc.

The Norelco MG 260H is constructed with X-ray tube and high tension generator completely enclosed in one unit. Maximum high voltage output is 260,000 volts, minimum is 100,000 and a stepless control permits smooth variation between these limits.

Unit is oil insulated and air cooled and is designed for load of 4 milliamperes. It operates from a 220 volt AC power supply and is compensated for a range of 210-240. When desired unit can be adapted for 110 or 440 volt operation.

Tube and generator unit are operated through long low-voltage cables connected to a control cabinet.

Circle No. 173 on Reader Service Card.

Safety Hat and Cap

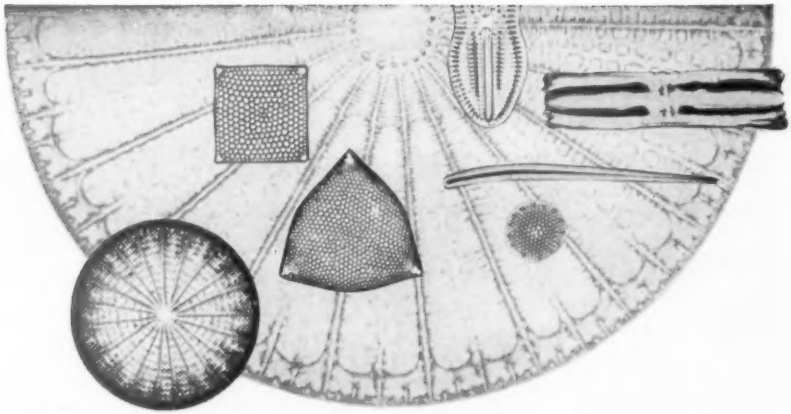
A new safety hat and cap with a full-floating headband completely adjustable to head sizes from 6½ to 8 is announced by Boyer-Campbell Co. Identified as Supergard, it is molded from flame-retardant waterproof material in seven different colors and meets all Govern-

ment specs GCG-H-142B as now in effect. There is no lacing involved in various head adjustments.

Supergard is also fitted with a new unique plastic cradle which gives high degree of hygiene. Only the sweatband need be replaced when transferring hat or cap from one employee to another.

No metal of any kind is used.

Circle No. 174 on Reader Service Card.



Diatoms from the deep for Acetylene Cylinders

Microscopic diatoms, by untold billions, compose the diatomaceous earth used as one of the four filler components in Norris-Thermador Acetylene Cylinders. Diatoms were living organisms, deposited on the ocean bed millions of years ago. Ages later, the waters receded, and today these deposits are employed in various fields of industry. Only specially selected diatomaceous earth is used in Norris-Thermador cylinders to give the filler higher porosity and lightness. As a result, the filler takes gas faster and more uniformly, while the safety of the cylinder itself is materially increased.

NORRIS-THERMADOR CYLINDERS

Have These Other Special Values

Check them: Cold-drawn construction . . . light-weight for easy handling . . . bases curled *under* for maximum strength and compact storage . . . larger cap holes — tags easily read without having to remove them . . . all welding x-ray controlled . . . specifications ICC 8 met and exceeded.

Acetylene cylinders from 10 to 300 cubic feet capacity.
Write or wire for specifications on all sizes. Cable: Northerm.

NORRIS-THERMADOR Corporation

5215 South Boyle Ave., Los Angeles 58, Calif., Dept. IW-956

3-1058A

Circle No. 3 on Reader Service Card.

New-Type Shop Watch

No hands or glass to break. This watch has revolving discs which indicates hours and minutes by numbers passing in front of apertures. Openings have windows of an unbreakable material so no dust or moisture can enter the case. Built for strength, it is fitted with aircraft shock-resisting movement. Lever escapement, anti-magnetic and recoil click spring prevent over-winding. Watch is guaranteed for one year by J. W. Leonard Co.

Circle No. 175 on Reader Service Card.

Lightweight Welding Curtains

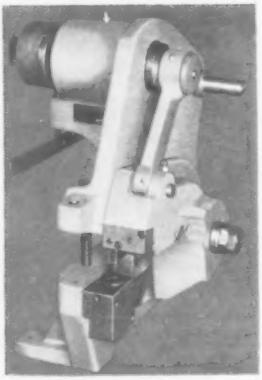
A nylon-plastic welding curtain has been developed by Herculite Protective Fabrics, Inc., for fire protection. The Herculite combination is said to be almost indestructible because it does not absorb shop oils and greases. Comes in colors for continuous caution in an area.

Only 1/3 the weight of conventional cotton duck, yet said to be 10 times stronger, Herculite curtains are easily handled and require less storage space.

Circle No. 176 on Reader Service Card.

LOW-COST ANGLE & FLAT IRON CUTTER

BATEMAN POWER SHEAR



The only Power Shear of its kind on the Market today . . . now in 2 Models.

Model No. 2 (shown at left) cuts 2" x 2" x ¼" angles and 2" x ¼" flats. Has blades and punches for Ornamental iron, Channel 1", Squares ¾" and hand rail.

NO GRINDING NECESSARY AFTER CUT
ONE STROKE CYCLE CLUTCH OPERATES BY HAND OR FOOT
FLYWHEEL WITH GEAR DRIVE FOR POWER
TAKES ONLY 2' by 27" FLOOR SPACE

Bateman Power Shear Model No. 2, with punch, ¾ hp motor and stand $495.00
(FOB Mineral Wells, Texas)
Shipping weight: 645 lbs.

WRITE today for complete information and name of nearest distributor.

Bateman Foundry and Machine Co. **Mineral Wells, Texas**

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Heavy-Duty

SANDER-GRINDER

5000 RPM

with EXCLUSIVE
Coaster Brake CLUTCH DRIVE

UL CSA APPROVED

Model U-199W
Complete with ABRASIVE wheel and Steel Grinding Guard

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For The Welder...

No matter how big or bulky your weld grinding, disc sanding or wire brushing jobs, you'll cut costs and speed up work when you switch to dependable MILWAUKEE power.

Powered by full 1½ HP ac-dc motor, tailor-made by MILWAUKEE to stand the gaff of every day heavy-duty service. Its high disc speed (5000 rpm) removes metal fast and because it's light weight, perfectly balanced and easy to handle, it cuts way down on operator fatigue.

Write for free folder SG2 for complete facts about this outstanding tool.

MILWAUKEE ELECTRIC TOOL CORP.
5318 W. State St. Milwaukee 8, Wis.

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Circle No. 67 on Reader Service Card.

Let's Get Down To Facts About CLAIMS—

Yes, we could run a full page telling you why our Products are better, but we prefer to have

HI-AMP

ELECTRODE HOLDERS

prove their advantages by actual test with others—that's why we say, ask your Dealer to demonstrate a HI-AMP and you'll "see" why Welders everywhere prefer it.

LENCO, Inc.

(Formerly Wagner Mfg. Co., Inc.)

JACKSON, MISSOURI

Weld with HI-AMP

Welding Regulators

A new line of low-priced, inverse-type oxygen and acetylene pressure regulators introduced by Airco Company. International is designed to meet needs of smaller shops where initial costs are a factor.

The Series 8000 regulators are compact in design: the two gauge type

measuring 4½-inches by 4½-inches and weighing 2 lbs. 4 ounces and the single gauge regulator measuring 3½-inches by 5½-inches and weighing 2 pounds, 1 ounce.

Regulator body is machined brass forging and spring case is a zinc die casting.

Other features of the regulators are molded rubber diaphragm with fabric insert, relief valves on oxygen regulators, reversible nylon seat, easy accessibility to internal parts—no pressure seals to break when servicing—and a rugged, porous, tin-plated metal filter.

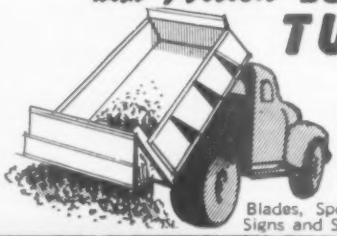
Circle No. 110 on Reader Service Card.

save on repairs

with Allied **BULLDOG**

TUF-A-BRASE

STEEL PLATE



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11%-13½% MANGANESE-NICKEL STEEL

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SOLE PRODUCERS

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Light Vertical Sander

A new, light-weight, high torque vertical sander designed for use with soft, resilient back-up pads and abrasive discs is announced by Master Pneumatic Tool Co., Inc. Precision gearing (no governor) gives the 5-lb. Model 201 speeds of 1800 and 3200 rpm in the current model, with 4000, 5000 and 6000 rpm tools to be released.

Tools are equipped with a three-step, thumb-operated throttle providing three different positive speed settings. Alternate choice is lever throttle handle for "feathering" finger control.

Air consumption at maximum horsepower is 31 cfm and stall torque is 5.2 foot pounds.

USE THE READER SERVICE CARD FOR VALUABLE REFERENCE DATA

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INDEXING TURNTABLES

CAMS

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SPOT WELDERS

GENEVA GEARS

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Fewer Wheel Changes . . . More Production with MANHATTAN MOLDISCS

Tests have proved Manhattan Moldiscs outlast 25 to 30 ordinary coated abrasive discs . . . even on the toughest finishing jobs. That's because they are custom-made for each particular job . . . for smoothing weldments, beveling edges, removing burrs and fins on mild steels, stainless alloys, copper and aluminum. Manhattan Moldiscs present a fresh, sharp abrasive cutting surface right down to the last usable part of the wheel without "loading" or glazing. And they're *safer* to use because they are reinforced with special super-strength synthetic fabric to prevent breakage on the job.

Manhattan Moldiscs are available in a wide range of types from harder, stiffer bonds for fast roughing . . . to more flexible and resilient bonds for fine finishing. Ask a Manhattan representative to show you why Manhattan Moldiscs, like all Manhattan high speed, heavy duty abrasive wheels last longer . . . give you "More Use per Dollar". RM-633

GRINDING WHEEL INSTITUTE MEMBER

WRITE TO ABRASIVE WHEEL DEPARTMENT

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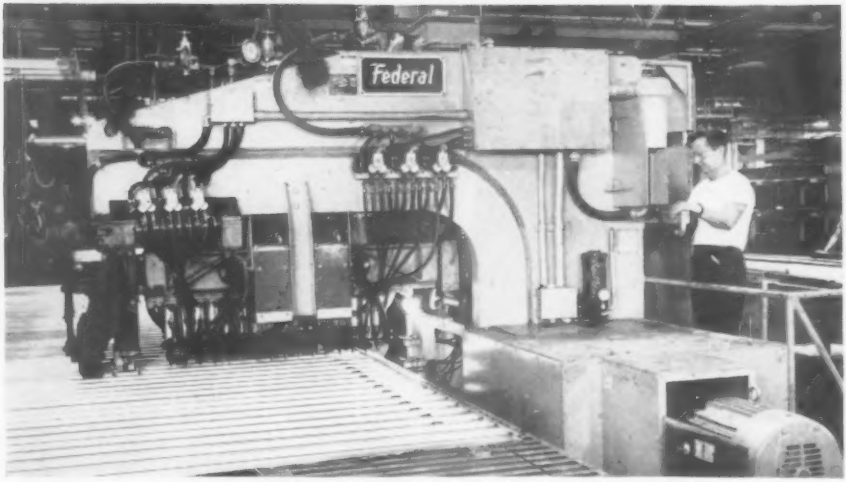
HOW Federal HELPS BUDD . . .



BUILD BETTER SUB-ASSEMBLIES FOR STAINLESS STEEL TRUCK TRAILERS

Welding trailer side panel sections of stainless steel for the popular new Fruehauf Volume Van required special welding machines. The Budd Company, one of the nation's largest manufacturers of transportation equipment, naturally, turned first to Federal.

Federal, in cooperation with Budd, designed and built an ingenious "C" frame multi-spot traveling welder that turned the difficult job of welding side frame panels and structural skirt sections into a high production operation.

Self-propelled on 120 feet of rail, the machine travels over the work which is laid horizontally on a copper shunt die back-up fixture. It features an adjustable slow speed for indexing with a rapid traverse for return. Two rows of tandem piston, double-acting air guns are indexed at right angles to the line of welder travel to permit close spot welding. The machine automatically positions itself and selects gun sequence. Operator, riding with the machine, always has clear view of work, ready access to controls.

If your operation calls for special resistance welding — you, like leading manufacturers, should call on *Federal — First in Resistance Welding.*

Federal® WELDERS

Warco® PRESSES

9801-A

THE FEDERAL MACHINE AND WELDER CO.

WARREN, OHIO

Circle No. 72 on Reader Service Card.

Inert-gas tungsten-arc welding of low alloy chrome - moly steels minimizes warpage, shrinkage and oxidation, reduces heat affected zones and makes cleaner welds.

Fabricating Low-Alloy Chrome-Moly? Use Inert-Gas Tungsten-Arc Welding

by **CHARLES BERKA, Editor**

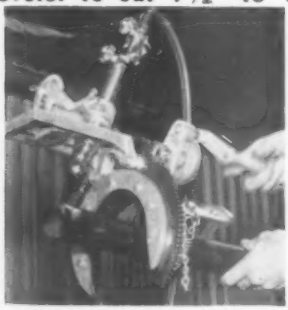
USE of inert-gas tungsten-arc welding on low alloy chrome-moly assemblies and sub-assemblies has increased quality and speeded production of welded components used in jet aircraft made by Republic Aviation Corp., Farmingdale, N. Y. Specified by the United States Air Force for its strength, SAE 4130 steel is used in landing gear sections, pilot seats, engine controls and gun chutes.

With the inert-gas tungsten-arc welding process, warpage, shrinkage and oxidation are minimized, heat affected zones reduced and cleaner welds obtained. The (light gage) metal had been welded by the oxy-acetylene process, but slowness of operation, excessive warpage and shrinkage dictated a change.

A DC motor generator set-straight polarity—was selected as a source of welding heat. However, with this unit, thoriated tungsten electrodes used would actually have to be touched to work to strike an arc. And this might cause contamination of the electrode.

Circle No. 74 on Reader Service Card.

H&M announces the MODEL "O" — a pipe Beveler to cut 1½" to 4"!



PATENT APPLIED FOR

PERFECT BEVELS — COMPLETELY PORTABLE!

(*Weight: 7½ lbs.*)

With the same split-gear horseshoe principle as H&M's larger models, the Model "O" offers the maximum in speed and **quality of bevels** on small diameter pipe! Rugged and dependable, H&M's Model "O" is easily operated by unskilled operators, and changing from one size pipe to another is a matter of seconds! Write immediately for fully illustrated brochure!

H&M PIPE BEVELING MACHINE COMPANY

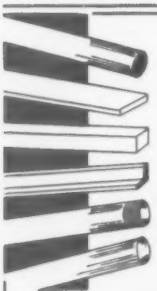
Tulsa, Oklahoma

TM REG. 311 E. Third St. Diamond 3-0241

The solution was to add a high frequency oscillator unit to the motor generator set. This unit

Easy starting of arc is made possible by high frequency unit added to motor generator set. Without unit, tungsten electrode used would actually have to be touched to work to strike arc. This could cause electrode contamination.

actually superimposes a high frequency AC current on the DC current. This current bridges the gap between electrode and work piece, providing a path for the DC cur-



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ANGLE IRON
PIPE
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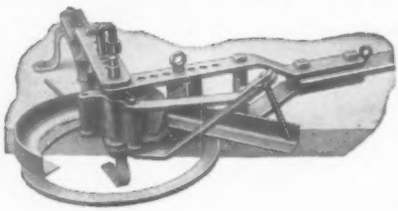
the HOSSFELD UNIVERSAL® IRON BENDER



Wrenchless, the Hossfeld Bender is always ready for use. It's easily and quickly set up for the 101 different bends needed every day in maintenance and production work. Adaptable, it replaces special bending equipment. For those hard-to-pull bends on heavier material, a Hydraulic Attachment (optional) enables one man to do the job.

Circle No. 75 on Reader Service Card.

rent permitting easy starting of the arc and in general increasing weld quality. The unit has automatic gas and water shut-off.

A thoriated tungsten electrode is used because it is less liable to contamination and burn-off. This electrode type also gives a more stable arc, thus minimizing porosity and inclusions and improving weld quality.

The company found it a simple matter to convert welding operators to the inert-gas tungsten-arc process because techniques used are similar to those employed with oxy-acetylene welding.

Welding is done at 30 to 150 amps with voltages ranging from 25 to 35. Filler metal is $\frac{1}{16}$ and $\frac{3}{32}$ inch carbon steel rod. Argon gas is used for shielding.

For Valuable Reference Material Available At No Charge
See Page 22

a NEW product means NEW time saving and important NEW production gains

York's
SPAT-R-PRUF COMPOUND 106

don't sputter about spatter . . .
JUST WIPE IT OFF

Completely eliminates grinding after welding. Just one coat, and spatter can be wiped away with a dry cloth.

- NO STIRRING OR DILUTION
- NON-TOXIC
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- NO ODOR
- HARMLESS TO SKIN
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- HELPS PREVENT RUST
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Available 1 or 5-gal. cans, 55-gal. drums

3 in 1 York's '77'
SPECIAL FLUX
FOR GENERAL BRAZING
FOR CAST IRON WELDING
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6665-CE

IMPROVE WELDING QUALITY WITH THE **TONG TEST**

AC-DC
AMMETER

Now you can measure actual AC or DC welding currents without losing valuable production time. The Columbia TONG TEST is simply clamped around the electrode cable. Instantly you get an accurate ampere reading to control and maintain welding quality. Interchangeable ranges available up to 1000 amperes.

Eliminate defects . . . increase production . . . maintain valuable equipment with the low-cost Tong Test Ammeter. Write today for 8-page Catalog IW-400.

Only Tong Test Measures Both AC and DC

COLUMBIA

COLUMBIA ELECTRIC MFG. CO.
4545 Hamilton Avenue • Cleveland 14, Ohio

Circle No. 73 on Reader Service Card.

1 Titanium ingots are made in vacuum melting furnace. Ingots are double melted to remove gases and secure highest possible purity.

2 After removal from water-cooled copper crucible, ingot is ready for drawing.

High Purity Filler Wire Extends

The largest application for titanium wire at the present time is in the aircraft industry, where titanium wire is being used as welding filler material. Since titanium can be welded only to itself, the arc is struck between the base metal and wire, which provides the filler metal. To achieve high ductility in the weld, an extremely low percentage of contaminants in the welding wire is imperative. High purity wire meets this need.

The welding of titanium and its alloys presents problems similar to other metals, but they are magnified by two major difficulties: 1) air contamination, and 2) changes in thermal condition at or adjacent to the weld. Any welding program should be preceded by consultation with manufacturers of titanium metals and its alloys, and the use of unalloyed low-hardness (low oxygen) titanium as a guide to correct welding procedure.

Successful inert-gas shielded arc welding is obtainable in several ways. Although perfect oxidation protection is secured only in a gas-tight pure-inert-gas welding tank, satisfactory shield can be obtained with either the non-consumable tungsten torch or with an automatic inert-gas gun. Trailing the gas shield behind the gun, to protect the cooling weldment, is necessary and inert-gas backing

3 In successive passes through this machine, wire is drawn to required gauge. Special lubricants are used.

4 Titanium wire surface cleaned during manufacture and again as a final step in production.

Use of Titanium Weldments

should be used. A heavy copper block with a shallow groove cut in it under the weld is commonly used.

Filler wire used with inert-arc welding equipment must not be pulled out of the protective gas blanket during welding, back filling must be avoided, and both filler metal and pieces to be joined must be completely free of oxides before welding. Multiple passes should be avoided, but when necessary, grinding or sand-blasting between passes should be employed to remove surface oxides.

Helium or argon are satisfactory for replacing the air. Helium permits faster welding; argon is believed to give better protection. Recently, mixtures of the two were found to give the best results. Actual gas flow rates and position or location of the welding nozzle and shield are of utmost importance. No welding should be done where there is a draft to disturb the gas flow.

With the proper set-up, welds have glossy metallic finishes without any signs of oxides on either top or bottom of bead. Until such shiny-metallic white beads have been obtained, there is no need of making physical tests of the joints produced.

Spot welding is relatively easy. The protection of inert gas is not

Story of titanium wire . . .

PROOF of the surging interest in titanium, is the rapid contribution of techniques developed by metallurgists for its economical processing and fabrication.

Two men who have been making significant contributions in this new field are James H. Johnston and Edward R. Funk, founders of the newly organized Johnston and Funk Titanium Corp. of Wooster, Ohio.

They have developed special processing methods for drawing titanium wire from ingots produced by consumable electrode arc melding in their own vacuum-melting furnaces.

As yet, the impact of titanium has scarcely been felt in the structural metals industry, largely because the purification costs are so high. Johnston and Funk are producing alloyed or unalloyed wire to individual specifications in gauges from 0.25" to .030", and have aimed their research and development work at the problem of bringing costs down substantially.

Their process calls for selected, blended sponge to be pressed into rounds. These are fed into a water-cooled copper crucible, where an arc is struck. The melting takes place in a vacuum in which the atmospheric pressure is reduced to about one micron-Hg (0.00002 psi). Diffusion pumps are used to produce this high vacuum.

To insure the highest possible purity, all ingots are double melted. Gases such as hydrogen, nitrogen, and oxygen —whose presence even in very minute quantities causes embrittlement—are drawn off instantly, resulting in an extremely high level of purity. This de-gassed titanium assures high ductility and uniform strength for the wire.

necessary, but cleaning of sheets by pickling is advisable. For effective results, the oxygen and nitrogen content of sheet material must be low and the carbon content not exceeding 0.25 per cent, although this value may be affected by other variables.

In spot welding, the weld strength is not affected by the direction in which sheet is rolled. The welding range is wide and need not be controlled too accurately except when particular strength welds are needed. Weld ductility is little affected by welding variable, and weld penetration is always relatively high in the range of conditions producing acceptable shear strength.

Titanium may be flash butt welded with some advantages over other types of fusion welding because the molten portion which has been contaminated by air is partially ejected from the weld. However, argon gas shielded welds are more ductile than non-shielded welds.

Techniques for other types of welding have not been fully developed. Flux-coated titanium electrodes are not available nor are fluxes for submerged melt

When one welder gives both AC and DC...

Handles every type of electrode...

Yet costs less to buy and operate...

WHY

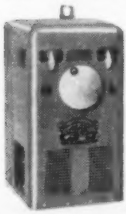
shouldn't you be using IDEALARCS for your production welding?

Certain electrodes work best on... AC

Other electrodes operate better on... DC

Some rods that work best on DC in smaller sizes... DC

work best on AC on the larger sizes. AC



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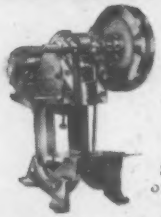

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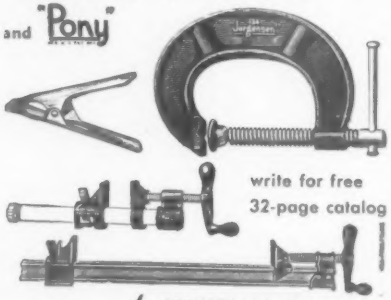

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welding. Oxyacetylene welding cannot be done on titanium. Percussion welding is yet untried, and resistance butt welding is not commercially satisfactory.

It should be noted that embrittlement of the weld still occurs to some extent in all the commercial alloys being marketed, however, heat treatment research and alloy development is expected to overcome this in the very near future.

On the other hand, since titanium retains its strength at elevated temperatures, it is extremely useful in services up to 1000° F. Its corrosion resistance is also an important factor in many industrial processes, and is particularly useful in the marine hardware field. Jet engines, supersonic aircraft, and guided missiles require titanium because of its high strength-to-weight ration. One airplane manufacturer has a jet engine on the boards employing titanium alloys in the entire construction.

The chemical industry also uses both titanium and titanium alloy wire in tanks, pipelines, and production vessels, as well as corrosion-resistant filters, racks, trays, and laboratory equipment.

Since the body of existing technical knowledge relating to titanium is so small, it has been necessary to do a great deal of basic research, to develop a host of special fabricating techniques. Special equipment has been designed and produced for handling titanium. Special processes have been devised for the numerous fabrications that are necessary in titanium production. Special lubricants have been developed for drawing operations. New heat treatments and cleaning techniques have also been worked out through laboratory research, pilot plant runs, and actual production.

VACUUM BRAZING . . .

(Continued from Page 85)

oxidation that would occur if internal heating element were located in the same chamber as the work, and the work were thus exposed to the gases emitted from the heating element.

O-ring seals in the mating flanges of each wall of the retort provide a tight vacuum seal, and are protected by water-cooling from the high temperatures produced within the chamber.

A 10-inch booster pump of the new "Ring-Jet" design, and a Model 412 "Microvac" rotary mechanical fore-pump, located on the floor below the furnace, provide ample capacity for rapid evacuation of the inner chamber to the high vacuum desired. Another small mechanical vacuum pump evacuated the space between the inner and outer shells of the furnace to a somewhat lower vacuum.

Duration of the vacuum brazing cycle is about a day and a half, or comparable to that with hydrogen-atmosphere brazing.

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Circle No. 82 on Reader Service Card.

HOW TO GET FASTER, MORE ECONOMICAL AUTOMATIC FLAME CUTTING is explained in a booklet just published by Harris Calorific Co. Company explains new system which has controlled preheat and cutting pressures that result in reduced slag and more economical cuts. **Circle No. 24 on Reader Service Card.**

AUTOMATIC WELDING WITH CONSTANT VOLTAGE AND SIMPLIFIED CONTROLS is the story told in literature from Hobart Bros. Co. Brochure explains how new power source increases production and lowers costs. **Circle No. 12 on Reader Service Card.**

WHY ABSOLUTE UNIFORMITY IS ESSENTIAL IN TUNGSTEN ELECTRODES is explained in a folder from North American Philips Co., Inc., Elmet Division. Folder explains how uniformity of its pure tungsten and thoriated tungsten electrodes contribute to efficient tungsten electrode inert arc welding. How-to-do-it instructions are given for the process. **Circle No. 83.**

EXTRA-STRONG, EXTRA-SAFE GRINDING WHEELS are the subject of Bulletin ESA-244 offered by Simonds Abrasive Co. Folder describes company's lightweight, rigid, and reinforced resinoid-bonded wheels which are said to be ideal for production grinding, weld grinding and cleaning-up. **Circle No. 155 on Reader Service Card.**

WHAT THE MAN ON THE JOB WANTS FROM REGULATORS is explained in literature from Victor Equipment Co. Brochure gives all design details and operating characteristics of company's complete line of single and two-stage regulators. **Circle No. 38 on Reader Service Card.**

A COMPLETE LINE OF RESISTANCE WELDING TRANSFORMERS is featured in a complete, illustrated 16-page brochure from Kirkhof Mfg. Corp. Brochure also describes company's line of standard and special welding automatic equipment for all welding processes. Company's facilities are described in detail. **Circle No. 156 on Reader Service Card.**

JOB-FITTED COATED FABRIC INDUSTRIAL WORK GLOVES are the subject of a colorful 16-page bulletin offered by Edmont Mfg. Co. Described and illustrated are a complete line of work gloves which are available with four types of coating—each for specific applications. Handy performance and chemical resistance preference chart is included. **Circle No. 157.**

TUBE AND PIPE NOTCHING TOOLS AND CUT-OFF MACHINES are described in a folder from Vogel Tool & Die Corp. Notching tools are said to make perfect joints for welding or brazing, cut clean edges and eliminate any need for further finishing. **Circle No. 27 on Card.**

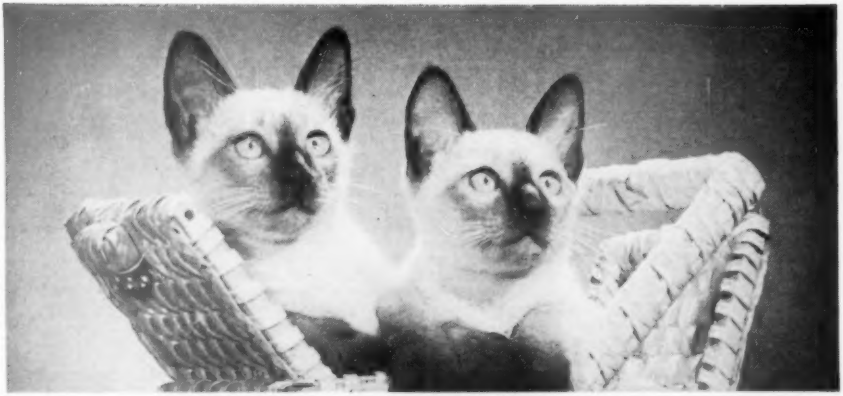
AUTOMATIC WELDING HEAD MANIPULATOR AND HOW IT WORKS is explained in Bulletin 6960 available from Lewis Welding & Engineering Corp. Described is "Universal" automatic welding fixture. Features, such as portability, rapid alignment and accuracy, are explained. **Circle No. 14 on Reader Service Card.**

TWO NEW ARC WELDER MODELS are introduced in literature offered by Hobart Bros Co. Described in detail and illustrated are new AC-DC welder and new DC rectifier-type unit. Design details and operating instructions are given. **Circle No. 2 on Reader Service Card.**

SOMETHING NEW IN REGULATORS is introduced in a 4-page catalog from K-G Equipment Co. Explained in detail are design features which virtually eliminate necessity for inside or outside regulator repairs. Stainless steel sintered filter which eliminates dirt, dust and even sand is highlighted. **Circle No. 49 on Reader Service Card.**

TREATED WELDING CURTAINS WHICH CAN CONFINE YOUR DANGER are featured in literature from A. Smith & Son, Inc. Folder explains how protective curtain holds in sparks and flames. Patented impregnating process used to make close woven canvas fireproof is described. **Circle No. 58 on Reader Service Card.**

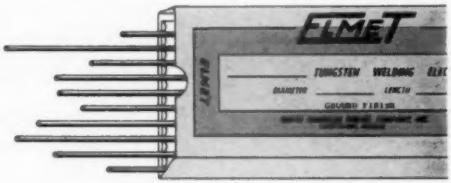
PRESS-TYPE RESISTANCE WELDING MACHINES and their design features are the subject of Bulletin 605 from Progressive Welder Sales Co. Colorful 6-page brochure describes typical spot and projection applications and gives complete specifications for each with various Progressive machines. **Circle No. 158 on Reader Service Card.**



ALIKE AS TWO ELMET ELECTRODES

Nature does it without even trying, but on the production line it takes a lot of human skill to attain absolute uniformity. In the making of Elmet tungsten electrodes, however, the result is well worth the extra effort. For Elmet electrodes are completely uniform, not only in surface finish and dimensions, but more important, in their composition, characteristics and physical structure. This means that, with Elmet, you get consistently superior performance from electrode to electrode with a minimum in readjustment of equipment and voltage.

Elmet pure tungsten and thoriated tungsten electrodes are furnished in cleaned finish and in the mirror-smooth centerless ground finish. They are available in packages of 10 in all standard diameters from .040" to ¼" and from 3" to 18" in length.



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INFORMATION ON TWO IMPORTANT WELDING PRODUCTS is contained in folder from York Engineering Co. Described are an efficient anti-spatter compound and an all-purpose welding and brazing flux. **Circle No. 76 on Reader Service Card.**

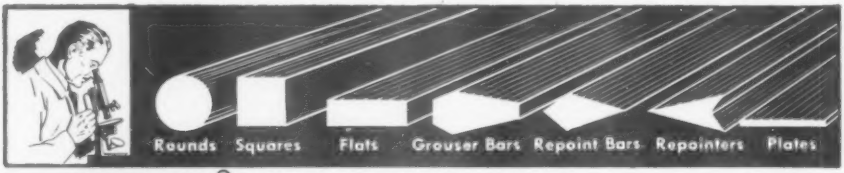
EVERY RESISTANCE WELDING NEED is featured in a complete catalog from WW Alloys, Inc. Featured are electrodes, cold formed offset tips, holders, seam welding wheels, castings, forgings, rod and bar stock. **Circle No. 160 on Reader Service Card.**

FIBERGLAS-MOLDED SAFETY HATS AND CAPS with no metal parts are featured in Bulletin No. 45 offered by Fibre-Metal Products Co. Described and illustrated is company's complete line of Supergard safety hats and caps that are molded of thermo-setting Fiberglas-reinforced, polyster resin. Hats and caps come in nine colors and meet various Federal specifications. **Circle No. 161 on Reader Service Card.**

DOUBLE THE LIFE OF YOUR WELDING AND CUTTING TIPS is the suggestion of Maitlen-Benson, Inc. According to the company, this can be done by using their Wypo tip cleaners whose exclusive circle design provides as many as 60 more cleaning edges per inch of cleaner. **Circle No. 162 on Reader Service Card.**

HOW "HIDDEN JOINT" ASSEMBLY BRAZING PROBLEMS can be solved is the message in brochure available from United Wire & Supply Corp. Folder describes company's complete line of copper, brass and aluminum brazing alloys and explains how they can be used. **Circle No. 59 on Reader Service Card.**

BETTER WELDING ON A WIDER RANGE OF JOBS is said to be a snap with new DC welder made by Vickers Electric Division, Vickers, Inc. Illustrated brochure available gives complete information on the company's Controlarc DC welder, including design details, operating instructions and other technical data. **Circle No. 7 on Reader Service Card.**



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High Bridge 8, New Jersey

Birmingham, Ala. Chicago, Ill. Cincinnati, O. Easton, Pa. New York, N. Y.

Circle No. 84 on Reader Service Card.

EIGHT STEPS TO EFFICIENT RESISTANCE WELDING OPERATIONS are explained in literature from S-M-S Corp. Descriptive folder explains how the company's complete line of resistance welding electrodes, wheels, pressure holders and adjustable adapters can speed up operations. **Circle No. 57 on Reader Service Card.**

STAINLESS STEEL TUBING AND PIPE and how they are fabricated is the subject of Data Folder TB-355 published by the Tubular Products Div., Babcock & Wilcox Co. The 6-page bulletin contains tables of analyses, mechanical properties, creep strength, physical properties and oxidation resistance of nine of the most popular stainless tubing steels. **Circle No. 163.**

THERE'S MORE TO AN ACETYLENE CYLINDER THAN MEETS THE EYE explains Norris-Thermador Corp. Literature available explains how cylinders are carefully filled with asbestos, charcoal, diatomaceous earth and cement to get an efficient, filler interior. Specifications for all cylinder sizes are given. **Circle No. 3 on Reader Service Card.**

11-13½% MANGANESE NICKEL STEEL PRODUCTS for hardfacing and build up applications are featured in catalog from Ford Steel Co. Described and illustrated are welding electrodes, wedge bars, wedges, cast-to-shape dipper-tooth repointers and applicator bars. Products are cataloged for easy reference and ordering. **Circle No. 87 on Service Card.**

IRON POWDER LOW HYDROGEN ELECTRODES, how they work and why they are used is effectively expalined in catalog from Alloy Rods Company. Described in detail is the company's Atom-Arc 7016 electrodes. Operating instructions are given and suggested applications listed. **Circle No. 41 on Reader Service Card.**

RESISTANCE WELDING ALLOYS for every resistance welding application are featured in complete catalog from Tipaloy, Inc. Described and illustrated is company's complete line, including spot welding tips, seam welding wheels and resistance welding alloys cast to shape. **Circle No. 11 on Reader Service Card.**

ON-OFF GAS SWITCH added to the Torch-O-Matic gas brazing and soldering torch made by Velocity Power Tool Co. is introduced in new literature. Described and illustrated is battery-ignited torch with gas switch that ignites instantly, electrically and shuts off automatically when switch is released. **Circle No. 46 on Reader Service Card.**

When a touch on a button moves weldments like these into the correct, most convenient position for a downhand pass, you get more arc time, more welding at lower cost. C-F power operated Positioners rotate the work in a full circle at any point in a range of 135° from the horizontal — giving welders a choice of an infinite number of downhand welding positions instantly.

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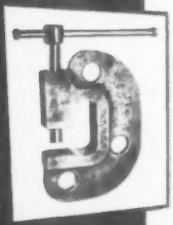

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NEWS

from page 40

N. J. Distributors Meet

A. C. Axtell, Past Eastern Zone vice president, National Welding Supply Association, discussed Association activities at a recent meeting of the New Jersey Gas Dealers Association.

Boston AWS Section Series

A group of six nationally recognized welding experts will speak before the "New England Regional Conference on Welding", to be held Wednesday, September 19, 1956 at New England Mutual Hall in Boston, Massachusetts. Topics will include: *Recent Advances in Weld-*

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ing Electrodes, The Mechanism of Brazing, A Weld Crack Susceptibility Test, The Fabrication of Titanium, and Welding with CO_2.

The conference has been planned by the Boston Section of the American Welding Society to provide a better exchange of technical ideas on a regional basis. The program of six sessions will be followed by a social hour and dinner in the evening.

Miller Builds Addition

A plant addition which added two acres of working area to its facilities was opened earlier this year by Miller Electric Mfg. Co., Appleton, Wisc. New facilities were laid out so that materials are fed in an uninterrupted flow to production lines. Lines, in turn, feed to a new three port loading dock.

Details and photographs are featured in the June-July issue of Memco News, copies of which can be had by writing to Miller Electric.

75 Years for Webb Corp.

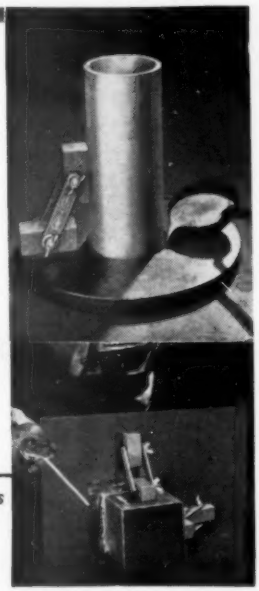
Seventy-five years of continuous production, growth and development are being celebrated this year by Webb Corporation, Webb City, Mo., manufacturers of sheet metal and fabrication machinery, welding fixtures and industrial weighing equipment.

To commemorate the event, Webb Corporation has prepared a colorful illustrated booklet which traces their growth from the early days of mine equipment production to the present large scale operations for many fields.

(More News on Page 126)

save set-up time and money

Forget bolts and clamps — use these tools for firm magnetic clamping on welding or assembly jobs and save a pair of hands.



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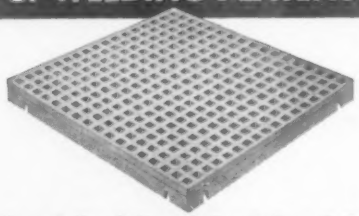

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BEVELS . . . fast, accurate precision work with ordinary hand torch . . . easy to use . . . models for all torches.

Improved BURNER'S AID

See your welding supply dealer. Booklet "Fundamentals of Flame Cutting" free from ARCAIR CO., P.O. Box 337, Lancaster, Ohio. P.O. Box 4227, Bremerton, Wash.

Circle No. 93 on Reader Service Card.

Keller Is Chief Engineer at Lewis Welding

Appointment of Robert G. Keller as Chief Engineer was announced recently by E. W. Hollis, general manager, Machine Division, Lewis Welding & Engineering Corp., Cleveland, Ohio. Mr. Keller will be assisted by Johan Muller, chief development engineer, Machine Division.

Both the Welding Division, located in Bedford, Ohio, and the Machine Division of Lewis Welding & Engineering now have completely integrated engineering departments and services.

USE THE READER SERVICE CARD FOR VALUABLE REFERENCE DATA

Manages Texas Plant for Norris-Thermador

C. G. Reavis has been appointed manager of the new Texas Division plant of Norris-Thermador at Waco, it was announced. Reavis heads the recently completed $400,000 facility which manufactures steel JATO subassemblies for Phillips Petroleum Co., prime contractor with the Air Force on a T-60 JATO contract.

A.W.S. National Banquet

Plans for the National Banquet of the American Welding Society to be held during the A.W.S. Fall Meeting in Cleveland, October 8-12, have been announced by William P. Mayor, banquet chairman.

The affair will be held at 7 p.m. on October 10th in the Main Ballroom of the Hotel Cleveland. Features include pre-dinner music, professional entertainment and after-dinner dancing.

Tickets, which cost $10 per person, can be obtained by writing Mr. Mayor at Lewis Welding & Engineering Corp., 70 Interstate St., Bedford, Ohio.

Glendale Elects Officers

Principal company officers were elected at the annual meeting of the Safety Products Division, Glendale Optical Co., Inc., Valley Stream, Long Island, N.Y.

HAROLD WEST

Chosen to lead the company are: Chester Lampert, president; Irving J. Volk, executive vice - president and treasurer; and Harold West, vice-president in charge of Sales.

CORRECTION

The abrasive pricing and specifications book issued by Bay State Abrasive Products Co. and recently described in INDUSTRY & WELDING Magazine contains pricing and discount data on the Bay State line only. Prices for other abrasives manufacturers are not given.

New Weld Fasteners

Availability of welding fasteners in a wide variety of sizes and types to meet customer's specifications has been announced by Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N. Y. The fasteners include welding screws, spade and bent spade screws, collar studs and nuts and designs to meet special applications.

Issue New Catalog Sheets

New catalog sheets and suggested sales price lists for their complete line of safety clothing and protective equipment have been issued by Aljay Mfg. Co., Inc., Philadelphia, Pa. According to Fred Jessar, president, new forms will be marked with N.W.S.A. Code Index numbers to make identification easier.

Circle No. 92 on Reader Service Card.

ALJAY'S SAF-T WELDERS CLOTHING

Designed to give long-lasting protection.

Also
- Gloves
- Welding Curtains

- Soft and Pliable
- Full Cut
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- High Quality

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No. 601

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NO-SPAT ***WELDING FLUID***

Fixtures, weldments and surrounding surfaces are kept free of spatter. Costly chipping and grinding is eliminated. NO-SPAT is non toxic, and also suppresses fumes, generated by welding! NO-SPAT prevents rust and it conditions metal surfaces for painting! Some users coat entire metal equipment with NO-SPAT for maximum ease of welding, rust prevention, and paint conditioning. Shipped ready to use.

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VISE-GRIP WELDING CLAMP

Made by PETERSEN MFG. Co., Dept. IW-9 Dewitt, Neb.

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